

Expert Evaluation of Raul Gonzalez, et al. v. Fidelity Exploration and Production Company

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EXHIBIT A

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Acronyms and Abbreviations

BMP	Best Management Practice
dB	decibel
U.S. EPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compound

Executive Summary

As an expert in the field of oil and gas operations and best management practices related to projects and engineering, and issues surrounding such, I, J. Daniel Arthur, P.E., SPEC, hold the following opinions with a reasonable degree of professional certainty:

Fidelity Exploration and Production Company (Fidelity) conducted drilling and production operations with knowledge of the close proximity to the Plaintiffs' residences. Fidelity continued drilling and production operations in spite of industry-wide knowledge of the risk posed by these operations conducted in proximity to residential communities. Fidelity made no effort to reduce the risk of impact posed to the community by use of Best Management Practices (BMPs). Such risk reduction efforts might have included, but would not have been limited to, implementation of mitigation measures to reduce exposure to noise, light, vibrations, traffic, dust, traffic, and catastrophic risk associated with drilling, completion, and production operations. The Plaintiffs' complaints of nuisances and neglect initiated from these subject wells stem from a lack or reasonable diligence that has impacted the local community.

1 Witness Statement and Qualifications

I, J. Daniel Arthur, P.E., SPEC, considered the information in the materials listed in **Appendix A – Works Cited** when forming the opinions stated in this report, as well as information provided by Jose W. Hernandez, Esq. The materials reviewed are listed in **Appendix B - Descriptive List of Materials Provided**.

I am a registered professional petroleum engineer (registered in 31 states), specializing in energy, engineering and water use, as well as environmental and other regulatory issues. I have approximately 30 years of experience in drilling, stimulation, mechanical integrity, seismic monitoring, enhanced recovery and the operation of a wide variety of well types in the United States and worldwide.

My experience has included Project Management, Best Management Practices (BMPs), contracting reviews and coordination with third parties, site inspections, and review of technical data (including drillers' files, technical reports, well integrity data, seismic monitoring, and groundwater monitoring and hydrogeological issues). While employed with the U.S. Environmental Protection Agency (U.S. EPA), I performed many hundreds of site inspections of oil and gas sites, injection wells, and ancillary facilities, while also performing investigations of potential environmental impacts. I have also supported investigations of alleged environmental and other impacts from oil and gas activities in every oil- and gas-producing state, served as a subject matter and testifying expert, and presented findings to high-ranking government officials and top-level management of major companies.

Additionally, I have experience evaluating the mechanical integrity of thousands of wells using many different types of testing and evaluation methods. Finally, I am expert at methods used to drill, test, stimulate, fracture treat, modify, and plug oil & gas and injection wells. This experience

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includes having a detailed knowledge of industry standard practices, BMPs, safety factors, and other common methods used to assure protection to human health, safety and the environment.

Attached in **Appendix C** is my resume, which outlines my training and experience, as well as a list of publications. Attached in **Appendix D** is a list of my recent expert testimony. For this work, I have charged \$350 per hour.

This report is preliminary and is subject to change if additional information is received. The opinions developed in this preliminary report are also subject to change based on that supplemental information. This report has been prepared in accordance with professional standards of care, skill and diligence. Internal quality control processes have been implemented to ensure the completeness, accuracy and clarity of this report.

2 Information Considered by the Witness in Forming His Conclusions

2.1 Drilling and Production Activity in Penitas, Texas

Table 1 below identifies the wells that are the subject of the plaintiffs' complaints. The subject wells were drilled by drilling companies contracted by Fidelity during the October 2010 through February 2012 timeframe. **Table 1** also specifies the start and completion date of activities and the duration of the drilling operations.

Table 1. List of the Subject Wells and the Duration of Drilling Period

Well Name	API No. (42 215-)	Drilling Period			
		Drilling Activities Commence	Drilling Activities Complete	Days Drilling	Drilling Contractor
B. E. GU 1-12	33957	8/8/2010	9/2/2010	25 days	Wisco-Moran
B. E. GU 1-10	33955	3/7/2011	4/8/2011	32 days	Wisco-Moran
B. E. GU 1-7	33954	9/24/2010	11/22/2010	59 days	Pioneer
B. E. GU 1-11	33956	4/9/2011	5/4/2011	25 days	Pioneer
West Temple 87	33997	4/11/2011	5/2/2011	21 days	Innodrill
West Temple 86	33996	5/4/2011	5/23/2011	19 days	Innodrill
West Temple 85	33995	5/24/2011	6/9/2011	16 days	Innodrill
West Temple 82	33999	6/12/2011	7/2/2011	20 days	Innodrill
West Temple 90	34004	7/30/2011	8/23/2011	24 days	Innodrill
B. E. GU 2-6	34014	9/9/2011	11/30/2011	82 days	Innodrill
B. E. GU 2-7	34015	12/1/2011	2/8/2012	69 days	Innodrill

The shortest straight-line distance of each subject well to the nearest residence is shown in **Table 2** and illustrated in **Figure 1**. As shown in **Table 2**, all eleven subject wells were drilled in close proximity to residences. All subject wells were within 1,300 feet of a residence, with the nearest well approximately 204 feet away from a residence.

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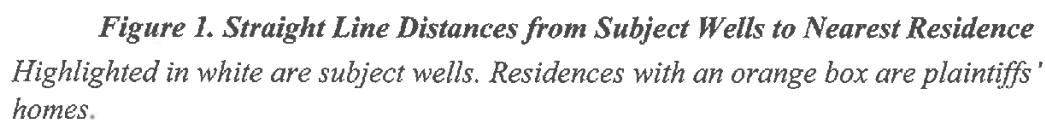
Table 2. Distance to Nearest Residence and Current Production Status of Subject Wells

#	Well Name	API No. (42 215-)	Distance to Nearest Residence (ft)	Production Status
1	B. E. GU 1-12	33957	235-ft	Not Active
2	B. E. GU 1-10	33955	204-ft	Not Active
3	B. E. GU 1-7	33954	230-ft	Not Active
4	B. E. GU 1-11	33956	259-ft	Not Active
5	West Temple 87	33997	551-ft	Active
6	West Temple 86	33996	852-ft	Active
7	West Temple 85	33995	494-ft	Active
8	West Temple 82	33999	1,257-ft	Active
9	West Temple 90	34004	489-ft	Active
10	B. E. GU 2-6	34014	301-ft	Active
11	B. E. GU 2-7	34015	323-ft	Active

These impacts could have been reduced, minimized, or mitigated through the use of common industry BMPs. The sources of these impacts and common BMPs are outlined in the following text. When appropriate, statements made during the deposition of company representatives from Fidelity's three drilling contractors will be used to provide insight and detail on the condition of the location during the drilling period.

2.2 Site Visit

On August 29, 2018, I, J. Daniel Arthur, P.E., SPEC, visited the subject wells located in Penitas, Texas. My goal was to ascertain the surroundings and develop an understanding of the conditions experienced by the residents in the vicinity of Fidelity's drilling, completion and production activities that occurred in close proximity to their residences. The site visit confirmed that the location of the subject wells in relation to the residences is as shown in **Figure 1**. Photos taken during this site visit are used throughout this expert report as figures and as examples of the current conditions of the subject wells.



2.3 Deposition of Wisco Moran's Corporate Representative Joel R. Bouldin, Jr.

Mr. Bouldin stated that the rig used during drilling operations did not have any vibration detection devices on any of the pumps or engines that were in service. Mr. Bouldin noted that the sub-structure of the rig sits on wooden railroad ties that sit directly on the ground so any vibrations from the rig were applied to the surface of the Earth. There were additional statements that the mud pumps and the generators had vibration reduction measures in place, but all other equipment was lacking these measures. It was also noted that operations were ongoing 24/7 and that lights were used both on the rig itself and to light the location.

2.4 Deposition of Innodrig's Corporate Representative Mark Pohlhammer

Mr. Pohlhammer stated that the rig used during drilling operations did not have any noise mitigation measures but that mud pumps and generators had vibration mitigation measures installed. Mr. Pohlhammer also noted the sub-structure of the rig sits directly on the ground so any vibration from the rig was transferred to the ground. There were additional statements that the rig did not have any noise mitigation measure beyond the pre-installed engine mufflers and that the rig itself was 50-100 yards away from the nearest resident at one point. It was also noted that operations were ongoing 24/7 and that lights were used both on the rig itself and to light the location.

2.5 Deposition of Pioneer's Corporate Representative John Blaine David

Mr. David stated that the rig used during drilling operations did not have any vibration detection devices on any of the pumps or engines that were in service. There were additional statements that the rig did not have any noise mitigation measure beyond the pre-installed engine mufflers and that hearing protection is required in certain areas of the rig. Further, Mr. David did not recall that any protective sound barriers were utilized during operations. It was also noted that operations were ongoing 24/7 and that lights were used both on the rig itself and to light the location.

2.6 Noise Pollution

Almost every operation and piece of equipment used in drilling, completions, and production of oil and gas generates noise. Some of the primary sources of noise include, but are not limited to, the drilling rig engine, compressors, brakes on the drilling rig, mud pumps, pipe handling, engines on trucks and other heavy equipment, and back up alarms on trucks and other mobile equipment.

In an article on "Noise Characterization of Oil and Gas Operations," Radtke et al. (2017) show that, on average, noise from drilling operations exceeds 66 decibels (dB) at 350 feet, and during completion operations the noise, on average, exceeds 68 dB at 350 feet. Community noise ordinances for residential areas typically require noise levels below 60 dB in the daytime and below 55 dB at night. Above these levels, noise interferes with normal activities such as conversation and can disrupt or diminish quality of life. In addition, continuous noise levels above 30 dB disturb sleep. Such noise can result in stress-related illnesses, high blood pressure, loss of sleep, and decreased productivity.

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While some noise from oil and gas drilling and production operations is unavoidable, there are a number of BMPs that can be used to reduce the off-site impacts of that noise. Noise impacts can be mitigated by orientation of equipment on the well pad, installation of supplemental mufflers on engines, use of electric motors, and use of sound walls and/or sound blankets. All of these BMPs were widely known prior to the drilling of the subject wells near Penitas, but were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors. In addition, the photo of one of the wells sites during drilling operations (see **Figure 2**) shows sound walls and sound blankets were not in use, further indicating that available BMPs were not implemented.



Figure 2. Google Street View Image of 1200 Jade St, Penitas, TX, Looking North, Showing the Drilling of the B.E. GU 1-7 in March of 2011

Approximate distance to the drilling rig location from residential property is 500 feet.

2.7 Light Trespass

Proper lighting during drilling and completion activities is essential to workplace safety and for compliance with aviation requirements. Lights on the drilling rig and lighting for work areas will be on all night, every night, for the duration of drilling and completion activities.

Light trespass occurs when light is cast where it is not wanted. Light trespass from drilling and completion activities can be distracting, and can interfere with the enjoyment of outdoor activities of nearby residents. However, the biggest potential impact of light trespass is the effect on sleep and the resulting impacts to human health. Importantly, research has shown that light trespass of only 10 lux affects the quality of sleep and cognitive function after only one night of exposure (for comparison, lighting in a typical living room is about 50 lux). Research has also shown that artificial light at night can negatively affect human health, increasing risks for obesity, depression, sleep disorders, diabetes, and breast cancer and impaired daytime functioning.

There are two primary BMPs for reducing light trespass from oil and gas activities: directional lighting and shielding. Directional lighting is simply making sure that lights are pointed toward the areas where lighting is needed and placement of the light so that it shines away from areas where light trespass may be a problem. Shielding involves the use of shades or other shields to focus light where it is needed. Such BMPs for lighting are commonly used and, according to information from the International Dark-Sky Society, have been required for the oil and gas industry in parts of Texas since 1978. These BMPs, though widely known prior to the drilling of the subject wells near Penitas, were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors. In addition, the photo of one of the wells sites during drilling operations (see **Figure 2**) shows location lighting that is visible during daylight. Light sources are not shielded, further indicating that available BMPs were not implemented.

2.8 Excessive Vibrations

As an oil and gas field develops, there can be many causes of vibration in the oil field. Practically every operation and piece of equipment used during the drilling, completion, and production of an oil and gas well can generate vibrations. Sources of vibration during the development process of an oil and gas well include the compressors, mud pumps, heavy equipment and trucks, and the drilling rig itself.

Excessive vibrations can damage nearby structures and can interfere, disrupt or diminish quality of life for nearby residents. In addition, continuous vibration can disturb sleep which can result in stress-related illnesses such as high blood pressure and decreased productivity.

Clearly, some vibrations during an oil and gas well's drilling, completion, and production are unavoidable, but there are a number industry-recognized BMPs that can be used to reduce the off-site impacts of vibrations. Vibration impacts can be minimized by use of rubber matting beneath equipment and by employing spring-mounted generators. If a piece of equipment is found to be overly vibrating, it should be replaced, as it may be malfunctioning or defective. Additionally, to ensure that drilling and production operations occur in a way that avoids unnecessary vibration

effects, a vibration monitoring program can be used to establish a baseline of vibration in the local area. Actionable levels of vibration from operations are determined and if a substantial increase is noticed, necessary action is taken as prescribed by a predetermined plan. The objective of this plan is to provide a framework for vibration management to ensure that vibration levels at neighboring buildings remain within reasonable limits throughout the work. These BMPs, though widely known prior to the drilling of the subject wells near Penitas, were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors

2.9 Odors, Gas Emissions, and Exhaust

A report by Adgate, et al. (2014), entitled "Potential Public Health Hazards, Exposures and Health Effects from Unconventional Natural Gas Development," shows that emissions from diesel engines and well completions as well fugitive emissions of volatile organic compounds (VOCs) from pipes, valves, and tanks can degrade local air quality near well pads during drilling, completion, and production operations.

Such emissions can result in noxious odors for residents within ½ mile of the well pad. These odors can interfere with outdoor activities, and can diminish quality of life. In addition, such emissions may exacerbate respiratory conditions such as asthma or emphysema.

These emissions and the accompanying odors can be reduced by a number of BMPs such as location of equipment on the well pad, use weighted hatches on production tanks, and the use of electric motors in place of diesel engines. These BMPs, though widely known prior to the drilling of the subject wells near Penitas, were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors. In addition, the lack of BMP implementation is further shown by an active production tank that was still on-site during the August 29, 2018, site visit (see **Figure 3**) that was not equipped with a weighted thief hatch to reduce fugitive emissions.



Figure 3. Image Taken during Site Visit on August 29, 2018, Showing an Oil and Gas Well and Associated Production Equipment in Penitas, Texas

2.10 Uncontrolled Dust

Dust is generated from many of the activities associated with drilling and production of oil and gas. Before drilling activities begin, the ground must be cleared of vegetation and leveled to create the well pad and the access road that leads to the well pad. In addition, because the access road and well pad are constructed of soil and gravel, truck traffic to the well pad and activities on the well pad can generate large amounts of dust in every phase of the operation. During completion, large amounts of dust can be generated from the proppant, typically sand, that is used in hydraulic fracturing. Because sand typically has a high silica content, dust from these operations may have a high silica content.

Dust consists of various sized particles (called particulate matter) suspended in the air. Particulate matter that is smaller than 10 microns can be inhaled, and are typically trapped in the nose, mouth and upper respiratory tract; however, finer particles can get into the lower respiratory tract and into the bloodstream where they can affect internal organs and can cause cardiovascular disease. People, especially young children and the elderly, with respiratory conditions such as asthma or emphysema can experience worsening symptoms as a result of even small increases in dust

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concentration. Silicosis, a serious lung disease, can result from inhalation of large quantities of silica dust.

Dust control has long been a standard component of oil and gas operations. For many years, produced water was sprayed onto roads and well pads to control dust. Now, fresh water is more commonly used. Another BMP that can reduce uncontrolled dust is to replace the vegetation that was disturbed during construction of the facilities required to produce an oil and gas well (**Figure 4**). Application of water to control dust is a widely used, effective, and economic BMP that was widely known and commonly practiced prior to the drilling of the Fidelity wells, but there is no indication that it was implemented. Furthermore, there is no evidence that Fidelity has attempted to restore the disturbed vegetation after construction was completed. These BMPs, though widely known prior to the drilling of the subject wells near Penitas, were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors.



***Figure 4. Image Taken during Site Visit on August 29, 2018, of an Oil and Gas Well
Surrounded by Disturbed Vegetation in Penitas, Texas***

2.11 Traffic Issues

The process of oil and gas development, especially during the drilling and hydraulic fracturing phase of a well, can create short-term, high-volume increases in traffic. Sources cited indicate that, over the lifetime of a single oil and gas well, there can be up to 1,340 truck visits to and from

that location. Nuisances from traffic impacts are intense during the initial drilling and completion period but taper off after the well completion process has ended. There is an increased volume in traffic present during the production operations of oil and gas wells but this volume is considerably lower during this phase.

Related literature concerning increases in truck traffic associated with oil and gas development note that both vehicular accidents and damage to road surfaces can occur as an oil and gas field progresses. Road damage is particularly possible in instances when the design parameters for traffic volume and weight loads are exceeded. Research has also shown that congestion and an increased risk of accidents are associated adverse impacts that can be endured by a residential community interwoven with oil and gas drilling and production.

Drilling and production companies can work with the local community to minimize effects of congestion and damage to roads caused by the increased volume of traffic during the process of oil and gas development. In residential areas in particular, arrangements and scheduling of operations that coordinate to local traffic patterns help to ease congestion and can reduce the effect of increased traffic. When feasible, developers can also use avoidance practices and alternative routes to help minimize traffic congestion on heavily traveled roads. Furthermore, following speed limits and adhering to weight-zone restrictions on roads are essential BMPs to reduce road damage caused by high-volume heavy truck traffic. In some cases, operators have negotiated compensation to local municipalities for road damage that occurs as a result of their activities. These BMPs, though widely known prior to the drilling of the subject wells near Penitas, were not implemented as indicated by statements made during the depositions of Fidelity's three drilling contractors.

2.12 Catastrophic Risk

In a presentation on "Community Exposures Near Unconventional Oil and Gas Development" for the Health Effects Institute (2018), and in a related article in *Environmental Science and Technology* (Adgate et al. 2014), John Adgate discusses how drilling and production operations pose the risk of catastrophic accidents that can injure or kill nearby residents. While catastrophic accidents from oil and gas operations such as blow-outs, fires, or chemical releases are rare, the presence of these risks and a lack of information about the risks creates psychosocial stress in the local population.

The stress from catastrophic risks can be reduced by notifying residents of the activities that will be taking place and describing the standard industry practices that will be followed to minimize those risks. This risk communication take be accomplished through public meetings or even through pamphlets distributed to nearby residents. Such risk communication strategies have been widely utilized by the oil and gas industry for decades. In the 1990s, in communities in Wyoming where multiple companies, including Fidelity, were involved in coal bed methane development, numerous public meetings were held to explain the technologies being used and the steps that companies took to reduce potential impacts. There is no indication that Fidelity implemented

BMPs to reduce the stress impacts of catastrophic risk related to its oil and gas drilling, completion, and production activities in this instance.

3 Principles and Methods

As stated above, this report has been prepared in accordance with professional standards of care, skill and diligence that require the following:

- The use of records with established provenance (date and source);
- The use of data relevant to the analysis;
- Evaluation of the appropriateness of the procedures used by the parties involved and their other experts, in the performance of their work;
- The use deductive reasoning; and
- Internal quality control checks of the findings and of the report.

This analysis has been prepared by well qualified professionals with many years of experience in the matters at issue, each with expertise in the subject and the ability to discern the appropriateness, validity and consequences of the methods used by the parties involved and their other experts, using the records provided.

The principles and methods described have been applied to the data provided to evaluate the reasonableness and meaning of the results reported with consideration of the timing of events. As part of the internal quality control process, this report has been scrutinized by more than one qualified professional for clarity, accuracy and rationale of deductive reasoning.

The field work in this matter has been performed by others, so to the extent that it is possible, the reported methods, conditions and measured values (such as well locations, distances, etc.) have been evaluated with consideration of their reasonableness, and the significance of the reported levels of accuracy.

4 Conclusions

Based on detailed review of the data and the information provided regarding Fidelity's drilling, completion, and production operations in close proximity to residents of Penitas, as described herein, the following conclusions apply:

- 1) Noise from drilling, completion, and production activities can have health and quality-of-life impacts. Noise can interfere with enjoyment of the outdoors. Additionally, noise can adversely affect the concentration of people working from home or school children trying to complete homework. Increased noise has also been shown to raise stress and affect quality of sleep. Noise impacts can be mitigated by orientation of equipment on the well pad, installing mufflers on engines, use of electric motors, and by use of sound walls and/or sound blankets. There is no indication that Fidelity implemented BMPs to reduce the impacts of noise related to its oil and gas drilling, completion, and production activities.
- 2) Proper lighting during drilling and completion activities is essential to workplace safety and for compliance with aviation requirements. However, light from 24-hour-a-day operations of a well pad can interfere with the enjoyment of one's home and can significantly reduce the quantity and quality of sleep. Loss of sleep can have a number of health effects and can increase the risk of accidents by those affected. Impacts of well-site lighting can be reduced significantly by directional lighting and proper shielding of lights to ensure that work spaces are properly lit while minimizing off-site effects. There is no indication that Fidelity implemented BMPs to reduce the impacts of light related to its oil and gas drilling and production activities.
- 3) Vibration from drilling and completion equipment can create damage to structures and can affect both quality of life and sleep, and can have adverse health effects. Vibration can be reduced by the use of rubber washers or specially designed stands that minimize the transfer of vibration from the equipment to the ground. The mud pumps and rig generators used on the drilling rig came to location with pre-installed rubber mats and vibration dampeners yet the remainder of the sources of vibrations had no additional vibration mitigation measures employed during operations. Additionally, the drilling rig sub-structure was positioned on wooden beams that were placed directly on the Earth's surface.
- 4) Engine exhaust, well completion activities, and fugitive VOC emissions are all widely known to result from drilling, completion, and production activities. These emissions can result in noxious odors that decrease the quality of life for nearby residents, and can exacerbate some respiratory conditions. These impacts can be reduced by a number of BMPs such as location of equipment on the well pad, use of weighted hatches on production tanks, and use of electric motors instead of diesel engines. There is no indication that Fidelity implemented BMPs to reduce the impacts of engine emissions from its oil and gas drilling and production activities.
- 5) Large amounts of dust can be generated during well pad construction and during drilling and completion operations. This dust is an annoyance that can interfere with the enjoyment

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of one's property and can be health hazard for anyone with asthma or other respiratory issues. Dust control is easily achieved with frequent watering of roads and well pads. There is no indication that Fidelity implemented BMPs to reduce the impacts of dust related to its oil and gas drilling and production activities.

- 6) Truck traffic related to drilling and completion activities as well as personal vehicles of site workers can have significant safety and quality-of-life impacts on nearby residents. The increased traffic creates a safety hazard for pedestrians, school buses, and children at play, and creates an increased risk of vehicular accidents. Both the increased volume of traffic, and the fact that many of the vehicles are large trucks with a wide-turning radius that residents do not typically encounter increase hazards associated with this traffic. In addition, the increased traffic volume can create road congestion that interferes with normal traffic flow and commute times. The total volume of traffic required for drilling and completions activities can be reduced by having site-workers park at a remote location, and busing them to the well site. Traffic hazards and congestion can be reduced by timing activities to minimize truck traffic during the times that school buses are running, and to avoid rush hours. There is no indication that Fidelity implemented BMPs to reduce the impacts of traffic related to its oil and gas drilling and production activities.
- 7) Drilling and production operations pose the risk of catastrophic accidents that can injure or kill nearby residents. The presence of these risks and a lack of information about the risks creates stress in the local population. The stress from catastrophic risks can be reduced by notifying residents of the activities that will be taking place and describing the standard industry practices that will be followed to minimize those risks. There is no indication that Fidelity implemented BMPs to reduce the stress impacts of catastrophic risk related to its oil and gas drilling and production activities.
- 8) For each of the impacts listed above, there are low-cost or no-cost BMPs that were widely known and commonly employed at the time of Fidelity's operations near Penitas. Thus, Fidelity knew or should have known about BMPs that could have mitigated the impacts of their operations on nearby residents, but failed to implement them. The Plaintiffs' complaints of nuisances and neglect initiated from these subject wells stem from a lack or reasonable diligence that has impacted the local community.

Respectfully Submitted



J. Daniel Arthur, PE, SPEC

Date:

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Appendix A: Works Cited

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Appendix B: Descriptive List of Materials Provided

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Document #	File Name	Document Description/Document Title
1	Deposition of Pioneer's Corp Rep. John Blaine David 10.24.13	Deposition of Pioneer's corporate representative John David Blaine taken on 10/24/2013
2	Deposition of Wisco Moran's Corp Rep Joel R. Bouldin, Jr. 10.23.13	Deposition of Wisco-Moran's corporate representative Joel Bouldin Jr. taken on 10/24/2013
3	Fidelity Case Document 33 P's Amended Complaint 01.02.13	Plaintiff's complaint
4	Moreno Case 01.12.17 Innodrill's Exceptions to P's 3rd Amended Petition and Subject thereto Answer and Jury Demand	Innodrill's response to plaintiff's complaint
5	Moreno Case 11.08.16 Defendant Wisco Moran Original Answer to Third Amended Petition	Wisco-Moran's response to plaintiff's complaint
6	Moreno Case NEAL ADAMS EXPERT REPORT Thursday-21 Dec 17	Expert report prepared by Neal Adams regarding plaintiffs' complaint.
7	Moreno Case Pioneer's Orig Ans & Spec Exceptions 12-20-12	Pioneer's response to plaintiff's complaint

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8	Moreno Case; 11.03.16 Stamp Filed - Plaintiff's Third Amended Original Petition.pdf-2	Complaint filed against drilling contractors and frac service company
9	Moreno Case; Moreno v Innodrill et al Appendices to Expert Report	Documents and files reviewed by Neal Adams for his expert report
10	Deposition of Innodrill's Corp Rep Mark Pohlhammer 10.24.13	Deposition of Innodrill's corporate representative Mark Pohlhammer taken on 10/24/2013

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Appendix C: Curriculum Vitae of J. Daniel Arthur, P.E., SPEC



J. Daniel Arthur, P.E., SPEC

President, Petroleum Engineer, Program Manager

Education

B.S., Petroleum Engineering, University of Missouri-Rolla

Professional Registrations

- *Professional Engineer*: Alabama, Arkansas, California (*pending*), Colorado, Florida, Idaho, Indiana, Illinois, Indiana, Kansas, Kentucky, Louisiana, Maryland, Michigan, Minnesota, Mississippi, Missouri, Montana, Nebraska, New York, New Mexico, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, South Dakota, Texas, Utah, Virginia, West Virginia, and Wyoming.
- *Society of Petroleum Engineers (International Professional Petroleum Engineering Registration)*: SPE Petroleum Engineer Certification (SPEC)
- *Certified Senior Project Manager*
- *Registered Water Well Driller via ALL Consulting, LLC (Pennsylvania, USA)*
- *Testifying and/or Consulting Expert in the following areas: Engineering & Engineering Design (various), Design-Build construction projects (various), Standard Contracts (e.g., NSPE, etc.), Engineering/Construction Standard of Care, Hydraulic Fracturing (including Frac Hits, injuries, safety processes, etc.), Water Treatment/Supply Systems (various), Impoundments/Reservoirs (various), Underground Injection (various aspects), Aquifer Exemptions, Well Integrity, Stray Gas/Gas Migration, Well Plugging and Valuation, Groundwater, Induced Seismicity, Alleged Impacts Associated with Hydraulic Fracturing, Well Interference, Spill/Release investigations (e.g., brine, condensate, NGLs, Oil, etc.), Contamination/Remediation (spills, releases, streams, and other various), Produced Water Treatment, Produced Water Pits & Impoundments, Pit Design and Closure, Salt Solution Mining (e.g., Cavern Stability & Integrity, Well Integrity, Gas Storage, etc.), Well Spacing, Unitization, Paying Well Determinations, Well Valuation, Well Plugging, Fast Tract Design/Build Projects, BOP Installation/Safety, Various Safety Engineering (e.g., Pipeline Pigging Safety, Flash Fires, Static Electricity as a Source to Flash Fires, Proper Grounding of Equipment, etc.).*

Distinguishing Qualifications

Mr. Arthur is a registered professional petroleum engineer specializing in fossil energy, planning/engineering, the entire lifecycle of water, resource development best practices, and environmental/regulatory issues. He has 30 years of diverse experience that includes work in

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industry, government, and consulting. Mr. Arthur is a founding member of ALL Consulting and has served as the company's President since its inception in 1999.

Prior to founding ALL Consulting, Mr. Arthur served as a Vice President of a large international consulting engineering firm and was involved with a broad array of work, including supporting the energy industry, various federal agencies, water and wastewater projects (municipal/industrial), environmental projects, various utility related projects, and projects related to the mining industry. Mr. Arthur's experience also includes serving as an enforcement officer and National Expert for the U.S. Environmental Protection Agency (EPA) and a drilling and operations engineer with an independent oil producer, as well as direct work with an oilfield service company in the mid-continent.

In 2016, Mr. Arthur was appointed to serve on a Steering Committee for Natural Gas Storage for the California Council on Science and Technology. Mr. Arthur's role on the Committee was primarily focused on well construction, integrity and testing based on his expertise, but also included overall analysis on issues such as global climate change and other issues (e.g., induced seismicity, gas markets, etc.). In 2010, as the shale boom was heightening, Mr. Arthur was appointed to serve as a Sub-Group Leader for a National Petroleum Council study on North American Resource Development. His Sub-Group focused on technology that is and will be needed to address development (e.g., hydraulic fracturing, horizontal drilling, production, etc.) and environmental challenges through the year 2050. Mr. Arthur was also appointed to a U.S. Department of Energy Federal Advisory Committee on Unconventional Resources. Over the last 20 years, Mr. Arthur has also served as a Peer Reviewer on several research documents and reports, including studies/investigations performed by the Government Accounting Office, various Universities, and also private research groups. And lastly, Mr. Arthur supported the U.S. Department of Energy through the Annex III Agreement between the United States and China to provide support relative to coal bed methane and shale gas development in China.

Mr. Arthur routinely serves as a testifying and/or consulting expert on a broad variety of issues that range from basic engineering to catastrophic incidents. He has also served to advise management and legal teams on a plethora of issues in an effort to avoid litigation, reach settlements, or develop strategies for future activities. His experience and continued level of activity on such issues has expanded his experience on a variety of issues, while also exposing him to an array of technical and forensic approaches to assess past activities, claims, etc. Mr. Arthur is also a member of the National Association of Forensic Engineers (NAFE).

Mr. Arthur has managed an assortment of projects, including regulatory analysis (e.g., new regulation development process, commenting/strategizing on new proposed regulations, negotiating with regulatory agencies on proposed regulations, analysis of implementation impacts, etc.); engineering design (including roads, well pads, design of various types of wells; completions/fracturing; water and wastewater systems, and oil & gas facilities); life cycle analysis and modeling; resource evaluations; energy development alternatives analysis (e.g., oil, gas, coal, electric utility, etc.); feasibility analyses (including power plants, landfills, injection wells, water treatment systems, mines, oil & gas plays, etc.); remediation and construction; site closure and reclamation site decommissioning; reservoir evaluation; regulatory permitting and environmental

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work; geophysical well logging; development of new mechanical integrity testing methods, standards, and testing criteria; conduction and interpretation of well tests; restorative maintenance on existing wells and well sites; extensive hydrogeological and geochemical analysis of monitoring and operating data; sophisticated 2-dimensional and 3-dimensional modeling; geochemical modeling; drilling and completion operations; natural resource and environmental planning; natural resource evaluation; governmental and regulatory negotiations; restoration and remediation; environmental planning, design, and operations specific to the energy industry in environmentally sensitive areas; water management planning; alternative analysis for managing produced water; beneficial use of produced water; water treatment analysis and selection; produced water disposal alternatives; facilities engineering for wastewater handling (e.g., disposal wells, injection wells, water treatment, water recycling, water blending, etc.); construction oversight; contract negotiations and management; contract negotiation with wastewater treatment companies accepting produced water; data management related to water and environmental issues; property transfer environmental assessments; and data management of oil and gas producing and related injection well data and information. He maintains experience with the technical and regulatory aspects of oil and gas and underground injection throughout North America. He has given presentations, workshops, and training sessions to groups and organizations on an assortment of related issues and has provided his consulting expertise to hundreds of large and small clients – including several major international energy companies and government agencies.

Specific to unconventional resource development, Mr. Arthur has gained experience in all aspects of planning, development, drilling, well completion, operations, and closure. Mr. Arthur has supported the evolution of various activities through this process that have included technical issues such as water sourcing, well drilling techniques, cement design, well integrity analysis, fracturing design & analysis, well performance assessment, production operations and facilities, well plugging & abandonment, site closures, and regulatory compliance. Mr. Arthur's experience covers ever major unconventional play in North America and on other continents. Moreover, Mr. Arthur's experience also includes work with horizontal drilling and various types of completions in both conventional and unconventional reservoirs and with various types of unconventional reservoirs (e.g., shales, limestones, coal).

As a petroleum/environmental engineer and senior project manager, Mr. Arthur's experience ranges from the drilling and construction of oil- and gas-producing wells to performing site characterization and remediation of soils and groundwater at a variety of sites throughout the United States to develop/protect groundwater supply resources. Mr. Arthur has also gained experience in evaluating large-scale resource plays, responsibility for drilling/completion and operations; conducting implication analysis of new laws and regulations, evaluating options for developing resources (based on economics, environmental impacts, water management challenges, and other factors), and conducting analysis specific to broad program development. Mr. Arthur's experience uniquely qualifies him for dealing with the complex issues associated with projects and concerns of the energy, natural resource, and environmental industries. Mr. Arthur is a recognized expert in the area of environmental law and regulations, as well as fossil energy, produced water,

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and environmental issues. He has managed large multi-discipline projects, has completed more than 100 publications/presentations, and has been a distinguished lecturer on numerous topics.

Relevant Experience

The following information is intended to demonstrate Mr. Arthur's experience and qualifications:

For **Fairway Resources**, Mr. Arthur is leading a team to assess providing water for oil & gas development operations in Major County, Oklahoma. For this project, Mr. Arthur serves as the Project/Client Manager and ALL Consulting has assessed options to transport fresh water via pipeline to Fairway's development area, which impoundments will be used to supply water on a rapid basis for completion operations. ALL Consulting also has evaluated the potential of Brackish Groundwater supply from the Hennessey Group (a Groundwater aquifer system). The project is expected to be completed in 2018.

For a Confidential Oklahoma Oil & Gas Producing Company, Mr. Arthur has been retained as an expert involving the hydraulic fracturing of a new horizontal well allegedly impacting an existing vertical well. For this case, Mr. Arthur is evaluating a variety of data related to both the horizontal and vertical wells, including well construction details, completion activities, pump curves collected during fracturing of the horizontal well, along with many other details.

For **Alta Mesa**, Mr. Arthur serves as the Project Manager for a large water infrastructure project in Kingfisher County, Oklahoma. The project includes planning, design, construction, and operation of water infrastructure for approximately 100,000 acres that are being developed by Alta Mesa. This includes in excess of 100 miles of water pipeline, water access from the Cimarron River, multiple water impoundments, various pumps, manifolds, and various other components. The project is being done on a full design-build (or Turnkey) basis with an overall budget of approximately \$100 million.

For a Confidential Client, Mr. Arthur was retained by the Plaintiff as an Expert involving multiple injuries that occurred during the repair of a Natural Gas Pipeline in the Oklahoma Stack Play. For this case, Mr. Arthur reviewed details of the event, including safety procedures, how compliance with OSHA rules and other standards were implemented, details and compliance with Company Safety Policies, and comparison of actions with various industry standards.

For **Republic Services**, Mr. Arthur is managing multiple projects pertaining to Class I Injection Wells for leachate disposal. This has included auditing third party injection wells, feasibility for new wells at more than 100 landfill sites across the United States, detailed analysis for the potential conversion of existing Class II wells to Class I, and other tasks. Work on these projects is ongoing.

For a Confidential Midstream Client, Mr. Arthur was retained as an Expert involving a fatality at a condensate processing facility in Southeastern Ohio. For this case, Mr. Arthur has reviewed available information, visited the site, inspected equipment, reviewed design and fabrication details, assessed site layout, and conducted forensic type analysis relative to the accident in an effort to assess causation and fault. This case is ongoing.

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For **Devon Energy**, Mr. Arthur is currently supporting Devon with the assessment of well integrity issues on various wells in the New Mexico Delaware Basin. This has included review of various details pertaining to individual wells, including daily reports, wellbore diagrams, casing programs, cementing records, geophysical logs, operational data, testing data, and other relevant information. This project is ongoing.

For a dispute between a Homeowner in Sand Springs, Oklahoma, and an Insurance Company, Mr. Arthur has been retained by Counsel handling the issue for the Homeowner as an expert pertaining impacts from seismicity on the residence. Mr. Arthur provided an independent analysis of the seismic event and alleged impacts to the residence. Mr. Arthur prepared an Expert Report and has been deposed by the Defendant. This litigation is ongoing.

For a Confidential energy services company, Mr. Arthur has been retained as an expert in regards to an accident that occurred during completion operations of three Utica Shale wells in Southeastern, Ohio. The accident included a fatality and Mr. Arthur's initial direction was to assess the scene of the accident and events that led to the accident.

For **Marathon Oil Corporation**, Mr. Arthur serves as the technical lead on a project in Oklahoma's Stack and Scoop plays. Specifically, ALL Consulting is assisting Marathon identify areas and subsurface geological formations suitable for high volume injection that exclude the deep Arbuckle Group due to concerns pertaining to Induced Seismicity. For this effort, Mr. Arthur led a team that assessed potential injection zones in a six (6) County area of Oklahoma (i.e., Kingfisher, Garvin, Canadian, Stephens, Grady, and Blaine). For the project, over a thousand injection wells were evaluated, including review of operational data, geophysical logs, well completion details, and other information. For the first phase of the project, high confidence areas were identified, including prospective target zones and various other details in what is currently Oklahoma's most actively drilled area of the state.

For a Confidential Client in Stephens County, Oklahoma, Mr. Arthur has been retained to assess impacts on multiple existing horizontal oil wells from completion activities at multiple new horizontal wells that were completed using hydraulic fracturing techniques. For this project, Mr. Arthur is evaluating well histories, production histories, well completion details, and other pertinent details related to the wells in question.

Mr. Arthur served as a Testifying Expert for a case in Kingfisher County, Oklahoma involved alleged impacts to a vertical well from a horizontal well completed in the same geologic formation. For this case, Mr. Arthur reviewed various technical details related to the completion of the horizontal well and vertical production well in an effort to determine if completion activities performed on the horizontal well negatively impacted the subject well. The Defendant's Counsel made a Daubert Motion to exclude Mr. Arthur's Testimony, which was denied by the Judge. As such, Mr. Arthur testified in Federal Court at a Jury trial and the Jury ruled in favor of the Plaintiff. Mr. Arthur has subsequently been retained to represent the same client in additional cases.

For **Energy Storage Ventures** and various subsidiaries, Mr. Arthur is managing a project pertaining to the permitting of a large natural gas storage project located in Ohio and very near the Ohio River. For this project, the ALL Consulting Team (including Mr. Arthur) has been asked to

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support ESV with coordination and communications with various regulatory agencies; to guide the permitting process and strategy; and to assess technical concerns raised by various regulatory agencies involved in the permitting process. This has included review of the design, monitoring, and the potential for subsidence considering the proposed brine impoundment (3.3 Million Barrel storage capacity) for the project will be located atop an abandoned coal mine, which is not uncommon in this part of Appalachia. This project is ongoing.

For **Halcon Resources**, Mr. Arthur services as a Senior Advisor and Engineer or Record for a large produced water recycling project located in West Texas. The project includes construction of a recycling system designed to manage 45,000 barrels of water per day (BWPD) and includes all surface facility components for conditioning water for direction to either a disposal well or recycling system which includes storage of more than 1 million bbls of produced water.

For **EXCO Resources**, Mr. Arthur is managing a wellhead and well integrity assessment as well as a gas migration investigation (GMI) in Pennsylvania. Mr. Arthur has performed several analysis and advised both EXCO and the Pennsylvania Department of Environmental Protection (PADEP) on technical details regarding the subject well's integrity. This has included review of pressure build-up tests, dye testing, isotopic analysis, geophysical log review, well drilling and completion details, operational details, and other miscellaneous information. Mr. Arthur also serves as the primary contact with the PADEP for EXCO.

For **Primexx Operating Corporation**, Mr. Arthur services as a Senior Advisor and Engineer or Record for multiple large produced water recycling projects located in West Texas. The projects generally include design/construction of fresh water storage impoundments; construction of multiple recycling systems designed to manage 30,000-45,000 barrels of water per day (BWPD); surface facilities required for treatment systems, disposal wells, and production operations; components for conditioning water for direction to either disposal wells or recycling systems; and other related infrastructure. The project also included overall planning for water to assure drilling and completion operations were fully supported. This multi-year project is ongoing.

For **Southwestern Energy (SWN)**, Mr. Arthur is managed a project in support of SWN's effort to identify a source for sand that could be used in completion operations for their assets located in Appalachia (Pennsylvania and West Virginia). This project is ongoing.

For multiple companies in Pennsylvania (including **Seneca Resources**, **PGE**, and others), Mr. Arthur managed projects pertaining to induced seismicity for Class II disposal wells being permitted in the State. Mr. Arthur and the ALL team work with industry and the Pennsylvania DEP in the development of custom permit conditions related to induced seismic monitoring and mitigation planning. The conditions negotiated with ALL's support are now the standard used by DEP. Through this process, Mr. Arthur presented technical information to the Department, supported negotiations, and managed the development of presentations and plans for use in monitoring and mitigation of micro-seismic events induced by the disposal of produced water via Class II wells. This included working with ALL partners in the specification of equipment, long-term planning, and all necessary aspects of a complete and appropriate system. Further, for Seneca Resources, once their Class II UIC permit was issued, ALL Consulting installed a monitoring

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system to meet PADEP requirements. This system is the first seismic monitoring system deployed in the State of Pennsylvania for an injection well project. The system is currently running and is managed by ALL Consulting.

For **Rockwater Energy Solutions**, Mr. Arthur is supporting a turnkey development project of Rockwater's Cedar Valley Water Facility. The Facility is being designed to handle more than 50,000 barrels of water per day (BWPD) for recycling, blending, and reuse. Mr. Arthur is supporting the project team as a Senior Advisor. The project is located in Blaine County, Oklahoma and is structured to support the Oklahoma Stack play.

For a confidential operator in western North Dakota, Mr. Arthur serves as an Expert related to a fatality case at a production well site near Dickenson. The incident involved a flash fire at a Heater-Treater. Mr. Arthur has supported outside counsel and the operator related to evaluation of the site, forensic analysis, analysis of selected equipment (e.g., Murphy Switch and flame arrestor), and other details specific to the incident.

Mr. Arthur was retained by the **Colorado Oil & Gas Conservation Commission (COGCC)** to serve as an expert on multiple gas migration cases in Colorado. Mr. Arthur's includes serving as a testifying expert covering the overall array of issues involved, ranging from well drilling/completion to groundwater impacts of area water wells. Mr. Arthur has also performed multiple training workshops for Commission staff on issues such as well integrity analysis; temperature/audio logging; and sustained casing annular pressure.

Mr. Arthur served as the Project Manager for a project with the **Oklahoma Liquid Propane Gas Administration**. For this project, ALL Consulting assessed the needs of the Administration relative to development of a new data system for use in managing the Administrations functions. Moreover, this includes incorporating the promotion of best practices into the system to better promote consistency, safety, efficiency, while allowing the Administration to fully and effectively implement the program they are legally required to manage. This project is ongoing.

Mr. Arthur currently serves as a testifying expert on multiple litigation case (including Class Action Law Suits) in Oklahoma pertaining to seismicity allegedly caused by Class II injection wells. Mr. Arthur has supported strategy on a technical basis, discussing various aspects of induced seismicity, supporting Counsel with determining venue (e.g., State or federal court), collecting and reviewing data from the OCC on injection well operations, and other analysis necessary to assess the subject events in question. This litigation is ongoing.

Mr. Arthur served as an expert for a litigation case between a midstream company and landowner involving a spill in Stephens County, Oklahoma. Although the case settled, Mr. Arthur supported the client with review and analysis of existing technical data and technical reports prepared by the Plaintiff's expert. Mr. Arthur visited the site, conducted analysis, and prepared an expert report, and supported settlement negotiations on a technical basis. The primary issue at hand in this case was a large release of crude oil from a pipeline and related impacts to the plaintiff's property. This required an extensive knowledge of soils, soil chemistry, remediation of crude oil in soils (e.g., land farming), soil handling/blending, related state guidance & requirements, as well as fully

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understanding Oklahoma's oil & gas historical operations as well as water well construction and related area geology/hydrogeology.

Mr. Arthur served as an Expert for litigation in Hughes County, Oklahoma that involves impacts from the hydraulic fracturing of a recent horizontal well and related impacts on a pre-existing Waterflood (i.e., within the Spaulding Booch Sand Unit). For this ongoing litigation case, Mr. Arthur served as an expert in regards to the hydraulic fracturing of the subject new well and mechanisms related to impacts to the pre-existing Waterflood. Other experts are addressing economic impacts and geology related details. This case settled out of court.

For **Protégé Energy**, Mr. Arthur serves as the project manager in advising Protégé on health, safety and environmental issues for development in the Eagle Ford of south Texas. The project was initiated after Protégé acquired a significant acreage position from Newfield Exploration. Activities performed by ALL Consulting and managed by Mr. Arthur included preparation of emergency response plans, SPCC plans, overall facility and well analysis; environmental assessment of the assets, and advising Protégé regarding necessary actions required related to the assets pertaining to HSE issues.

For the **Environmental Defense Fund (EDF)**, Mr. Arthur serves as a Senior Advising Expert on a variety of issues on a worldwide basis. In this role, Mr. Arthur has assisted EDF with a variety of issues on a technical and regulatory basis, including assessing catastrophes that have occurred (e.g., Aliso Canyon Gas Storage Project in California). Mr. Arthur has also supported EDF on issues such as impoundment design and construction for water storage, pipelines, regulatory programs, well evaluations, and more.

For a Confidential Client, Mr. Arthur was retained to examine and provide an expert opinion pertaining to work performed by an Engineering company for a water treatment system in Alberta, Canada. Mr. Arthur's role included assessment of contracts, performance documentation, standard of care, alleged technical deficiencies, compliance with local codes, and other details. In this case, Mr. Arthur has worked with both inside and outside Counsel. This case is ongoing.

For a Confidential Client, Mr. Arthur was retained to examine and provide an expert opinion pertaining to activities at a Department of Defense facility in the Eastern United States. The subject matter of the case involved a multi-million dollar fast-track design/build project. Mr. Arthur assessed contracts utilized, federal contracting clauses that apply relationship between the Prime Contractor and the various Subcontractors, Standard of Care issues, engineering design processes, construction and construction management, and other issues. This case is ongoing and scheduled for Arbitration.

For a Confidential Client, Mr. Arthur was retained to examine and provide an expert opinion pertaining to the condition and integrity of a Marcellus Gas Well in Pennsylvania that is part of a significant enforcement action and also litigation. For this project, Mr. Arthur serves as a Consulting Expert. As part of his investigation, he reviewed various types of cement evaluation logs, temperature and audio logs, mud logs, daily drilling activity reports, reports documenting remedial measures and partial plugging, isotopic sampling results, hydrogeological investigation reports, and various other sets of information. This project is ongoing.

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ALL Consulting was retained by a Confidential Client to provide an Independent "third party" evaluation of their produced water treatment technology. The technology's developer is based in Europe and pilot testing is occurring in the Permian Basin of West Texas.

For a Confidential Client, Mr. Arthur has served at the Senior Advisor and Environmental Manager (Contract Basis) for a company with oil & gas assets in the Permian Basin of New Mexico. For this project, ALL Consulting is fully supporting all environmental and regulatory aspects of the project, which involves re-entry of several existing vertically completed wells for re-completion as horizontal wells. This has included assisting the company register as an operator in New Mexico, addressing financial security requirements, permitting, coordination with state and federal regulatory agencies, NEPA evaluation and compliance, air compliance, SPCC compliance, and various other details required to support the client.

For the **City of Hudson, Ohio**, Mr. Arthur serves as the Senior Advisor for a project involving a salt solution mining well and associated facility to be used by the City for brine production. The produced brine will be used for ice control and water softening. ALL's work has included feasibility analysis, geological analysis, permitting & regulatory support, cost analysis, and development of the well and facility, including design, construction, and start-up operation.

For **Samson Energy**, Mr. Arthur is serving as the Senior Advisor on a Produced Water recycling facility in the Permian Basin of West Texas. The project involves the design and construction of a 40 MGD facility that includes treatment, storage (multi-cell impoundment), connectivity to existing pipelines, and various ancillary details. In this project, Mr. Arthur supports ALL's Project Manager, Civil Engineering Group, Water Systems Group and Environmental Group on various aspects of the project. Mr. Arthur has also supported the ALL Project Manager in presenting conceptual plans and designs to the client, including the CEO and representatives throughout the company on issues pertaining to this system and with regard to how a water system could be managed by the company and billed to various partners and adjacent operators.

For a Confidential Client in Pennsylvania, Mr. Arthur is managing a gas migration investigation (GMI) involving approximately 20 Marcellus Shale Gas wells. As part of this project, Mr. Arthur has served as the Technical Expert on issues pertaining to GMI, well integrity analysis, well remedial analysis, and has supported other consulting experts on groundwater and isotopic sampling and analysis. Further, Mr. Arthur designed the well integrity analysis program, designed testing protocols, oversaw testing and remedial work, interacted with landowners and industry staff, oversaw remedial work, and served as a primary contact with the Pennsylvania DEP.

For a Confidential Client in West Virginia, Mr. Arthur serves as the Program Manager in support of the client's "Well & System Management" program involving several Class II Disposal Wells. This includes supporting the client in regards to well evaluations (e.g., Operations, Performance, Integrity, Productivity, Maintenance, etc.); system evaluations (e.g., facilities, chemical additives, emission); and activities related to well integrity analysis and workovers. Further, Mr. Arthur is tasked to manage the Client's new well development program. Work is performed in a team effort that includes staff from the client, ALL Consulting, and contractors (as needed). In Mr. Arthur's

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role, he provides updates and communications with the Client's executive management team and technical managers.

For a Confidential Client with operations in Northeastern Pennsylvania, Mr. Arthur serves as the Project Manager and Technical Expert on multiple gas migration investigations involving multiple water supply wells and over 30 gas production wells. As part of this project, Mr. Arthur has led the planning and analysis from a technical and strategy perspective. The project included working with multiple attorneys and company representatives through the process. This project is ongoing.

For the **Florida Department of Environmental Protection**, Mr. Arthur has been retained as a technical expert for the investigation of alleged environmental impacts resulting from the drilling and completion of a deep unconventional horizontal well in Collier County, Florida. The project involves seven (7) separate law suits and includes comprehensive investigation of the subject oil & gas well; drilling of a deep monitoring well (to 1,800 feet); assessing previously plugged wells, assessing the well pad and associated surface activities; assessing integrity of the production well; regulatory development; review and evaluation of permit applications; providing technical support and guidance to the Department on Oil & Gas related issues; supporting the Department with meetings involving industry and local government entities; and other miscellaneous tasks. This project is ongoing.

For a large Engineering Firm (Confidential), Mr. Arthur is currently serving as a Testifying Expert in an Arbitration case involving the design/build of facilities associated with waste management and disposal wells located in Wyoming, Oklahoma and Texas. For this case, he has provided expert opinions on engineering practices, client communication, contractual obligations, fast tract design/build processes, project management, equipment specifications, and other items related to the subject facilities.

For the **Ohio Attorney General** and **Ohio Department of Natural Resources**, Mr. Arthur was retained as a Technical Expert for a case of alleged contamination associated with Shale Development in eastern Ohio's Utica Shale development area. This project has involved review of oil & gas well drilling, completion and plugging practices since the 1800s as well as modern and ongoing development of Utica Shale wells.

For **Saudi Aramco**, Mr. Arthur served as the Program Manager involving the support of Shale Gas development in Saudi Arabia. This includes evaluating various historic practices in the Kingdom on issues such as air, water, waste, water treatment, NORM/TENORM, safety, well integrity, casing & cementing, chemical screening for hydraulic fracturing, well design, hydraulic fracturing, well spacing, interference between production wells from fracturing, etc. The project has included field visits to Aramco's operations in each of their developing Shale Gas fields.

Mr. Arthur has been engaged as a Senior Program Manager with the Ground Water Protection Council (GWPC) and several State Regulatory Agencies on data management issues related to the Risk Based Data Management System (RBDMS), which he has been involved with since approximately 1990 and the hydraulic fracturing chemical disclosure site (FracFocus). For these and other projects, Mr. Arthur utilizes his knowledge of technical details associated with the energy industry, environmental regulations, and data management to support implementation of a

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variety of projects. Mr. Arthur has also made several presentations on both RBDMS and FracFocus, as well as analyzing data from FracFocus along with other data sets for purposes of benchmarking, modifying completion practices by industry, and screening of chemicals used by the energy industry.

For a Confidential Client, Mr. Arthur served as the Project Manager and Senior Advisor for multiple Class II disposal well projects in both Texas and Oklahoma. These projects included siting, permitting, design, drilling, direction and oversight of facility construction, initiation of operation, and ongoing compliance.

For a Confidential Client in Appalachia, Mr. Arthur supported a major water terminal having a fresh water capacity over 90 MGD and AMD water of over 20 MGD. Objectives of the terminal include water sourcing for drilling and hydraulic fracturing, treatment/blending of water recovered during flowback and commercial production, management of wastes, and management of water logistics. Mr. Arthur serves as the lead engineer for the Terminal.

For multiple Confidential Securities Clients, Mr. Arthur is/has supported market analysis efforts; technical evaluation of prospective assets for purchase or funding; upgrades to existing well/facilities; planning/design of new wells/facilities; value engineering; and construction management. These projects have occurred in the North Dakota Bakken, Eagle Ford, Permian, Utica, Fayetteville, Mississippi-Lime, Niobrara, Marcellus, and also in other conventional and unconventional resource development areas. Although each project has varied, all have *generally* related to water sourcing, transportation, water disposal, water accounting, and/or water treatment/conditioning.

For a confidential client, Mr. Arthur served as a Consulting Expert on an Arbitration case between a large oilfield service company and a water treatment technology company. In this case, Mr. Arthur provided expert opinions pertaining to the treatment company's technology, history on the type of treatment used relative to claims made by the treatment company, processes used to validate the effectiveness of the treatment technology, and other applicable technical, contractual, and process oriented details.

For **Lonestar Resources**, Mr. Arthur serves as the Client Manager for Lonestar's development in the Eagle Ford Shale (Wilson County) and also West Texas (Knox City area). Work has included preparation of SPCC plans, air quality permitting, spill response and follow-up, coordination with state and local regulators, acquiring various county permits (e.g., 911 addresses, driveway permits, development permits, floodplain permits), floodplain permitting using HEC RAS modeling for well pads fully in the floodplain, and other miscellaneous tasks.

For a Confidential International Service Company Client, Mr. Arthur serves as the Client Manager. Work to-date has generally included permitting support relative to managing drilling muds and mud processing. This has included establishing best practices, details on spill containment, sizing for secondary containment, waste classification, and permitting. Mr. Arthur lead the effort to permit the first Liquid Mud Re-Processing Plant in the State of Ohio for this client.

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For a Confidential Client that is very active in the Utica Shale of eastern Ohio, Mr. Arthur serves at the Program Manager for EHS, Regulatory, and also supports Drilling, Completions and Operations. In this role, Mr. Arthur supports EHS, Regulatory, Water, and other activities. Activities managed by Mr. Arthur and supported by ALL Consulting have and continue to include:

- **Corporate EHS Policy:** Mr. Arthur prepared the corporate EHS policy for the Client as well as guiding principles. This policy and principals has been disseminated to all staff and contractors with discussion and follow-up regarding implementation through Company Men and Superintendents.
- **EHS Program:** Mr. Arthur has taken the lead at developing a comprehensive EHS program from a grass roots basis. This has included coordination with the Client's President, Chief Operating Officer, Board of Directors, and Legal Representation; establishing a direction on EHS issues; coordination and collaboration with state regulatory agencies; preparation of a field practices manual that includes core safety and compliance information, best practices (e.g., maintenance of geomembrane plastics), and standard procedures (e.g., setting grounding rods); establishing a core EHS team comprised of staff from the Client, ALL, and other consultants managed by Mr. Arthur; as well as other tasks commonly implemented by a EHS Manager. Mr. Arthur is directly responsible for every aspect of the Client's EHS and Regulatory program and supports other programs.
- **Safety:** Mr. Arthur managed field safety in a collaborative manner with the COO. This includes development of safety procedures, staffing, response to events, tracking, OSHA compliance, and other miscellaneous tasks.
- **Drilling & Completions:** Mr. Arthur supported drilling & completion activities for a major drilling program, one of the largest in the Utica Shale. This included support of operations through spudding wells through completion activities on wells having some of more significant pressure regimes in the country. As such, Mr. Arthur assisted with and/or led analyses on well construction/design, casing, cementing programs, integrity testing, drilling surface operations, equipment and product selections, completion (i.e., fracturing) design, simultaneous operations, pressure management between wells, impacts to offset wells, and more.
- **Well Pad and Access Road Design:** Well pads and access roads are a critical aspect of development. For this client, as well as other clients, Mr. Arthur has served as the "*Engineer of Record*" for the design and permitting of well pads and access roads in Ohio's Utica Shale. This has included responsibility for baseline water sampling, wetlands clearances, stormwater plans, drainage, geotechnical, design, and coordination with regulators. As part of ALL's efforts, Mr. Arthur managed the first review of a well pad assessment by the ODNR's engineering and environmental group under the State's new proposed well pad rules.
- **Best Practices:** As part of implementing the EHS program, Mr. Arthur has collaborated with the Client and the ALL team on the development of several new practices pertaining

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to both safety and environmental issues. This has ranged from safety practices near well cellars, how geomembrane plastics are used at cellars, how cellars are constructed, use of soil cement, testing of well pad permeability, pad design components, maintenance of geomembrane plastic berms, grounding equipment, and so on. These improvements have resulted in improved EHS performance that has been observed by the Client and state regulatory agency. The overall improvements were clearly made possible through an aggressive plan and high level of collaboration at all levels.

- **Spill Containment & Prevention (Miscellaneous):** The state of Ohio's rules on spills, releases, investigation and response can be strict in comparison to other oil & gas producing states. At Mr. Arthur's Direction, ALL has conducted a complete overhaul of the Client's spill program. This has included incorporating new road and pad design specifications, use of semi-impermeable layers in pad construction, use of geomembrane plastics, specification regarding types of containment, management of truck traffic to properly care for containment, development of inspection and repair procedures relative to containment, modification of under-drain systems, management of stormwater, etc.
- **SPCC:** ALL has assessed all facilities operated by the Client and has documented required improvements and is managing upgrades to achieve compliance with SPCC Program standards. ALL is also preparing modified SPCC plans as prior plans were found to be inadequate.
- **Air Quality:** ALL managed air quality permitting for the client and manages supporting consultants and contractors performing activities such as stack testing. Mr. Arthur has ALL's air quality team and taken a lead role in management of responses to Section 114 letters, GHG program requirements, flaring issues, engine selection (rented and purchased), retrofits to achieve compliance with permits, and ongoing compliance management.
- **Waste Management:** Due to the number of different wastes generated during the development process, ALL has developed a waste management plan for activities in the Utica Shale. Core to developing this process has been auditing of commercial waste facilities used by the client, waste classification, sampling and laboratory analysis, waste management, waste transport, waste handling, and all other aspects associated with a complete program. Significant work has also been conducted in the area of NORM and TENORM considering state laws in Ohio, which are some of the most stringent in this area among oil & gas producing states.
- **New Rules:** The state of Ohio has several new rules that will become effective in 2014, including rules covering simultaneous operations, well pad design, water hauler monitoring, and others. Mr. Arthur has worked closely with the ODNR on these rules, impacts of the rules, and preparation for complying with the rules once they become effective.
- **Water Sourcing/Water Management:** Early development in the Utica involved water procurement from landowners, municipalities, and commercial vendors. However, as

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longer-term development continues, a more lasting solution for water sourcing and transportation is required. Mr. Arthur is currently leading this effort with staff from ALL, the Client, and outside vendors. This includes consideration of various alternatives, regulatory constraints, water accounting issues, water transportation, compliance issues, reuse/recycling, potential treatment options, water chemistry and consistency considerations, and disposal. Work has also included assessing water transfer routes, working with contractors, filing permits and water use summaries, etc.

- **Emergency and Spill Response:** ALL has established and implemented an emergency response group based out of our office in Cadiz, Ohio. Due to the critical nature of spills and releases in Ohio, we have also implemented a spill response team and are the primary responder and notify the state of any reportable spill that occurs on the Client's assets. This has included the use of field staff and equipment for sampling and assessing the severity of events that occur. ALL then serves as the primary liaison with the COO and Client's Management Team.
- **Contractor Management:** Mr. Arthur has made direct contact with contractors, service companies, and consultants supporting the client. He has made decisions on which contractors to hire and which to release and worked with the COO to establish such criteria. Mr. Arthur also initiated a Safety and Environmental Excellence Program with a highly used service company in an effort to supplement the company's Process Safety Management (PSM) program in an effort to increase safety and improve environmental performance.
- **Construction Management:** For the project, ALL oversees construction on roads, pads, impoundments and other earthen structures. This includes contractor management, coordination with landowners, and state and local regulatory officials as necessary.
- **Critical Activity Oversight:** ALL has provided Engineers and Geologists to be on-site during critical activities, such as spud meetings with regulators, determining set points and setting casing, FIT testing, cementing, completion activities (when pumping), site preparation (e.g., installation of geomembrane plastics), drill outs, etc.
- **Research:** ALL is currently initiated a research program with regard to spill containment and prevention. This includes assessment of geomembrane plastics, welding and installation of these plastics, pad design, design alternatives, equipment selection, alternative testing, installation methods, etc. ALL is in the process of including the Ohio Department of Natural Resources and two in-state Universities to assist with the research. The goal would be to improve spill containment, minimize the use of plastics (which are typically landfilled), and improve overall environmental performance.

For a Confidential Client operating in the Marcellus Shale Area, ALL has supported the client relative issues involving stray gas (or wellbore methane intrusion). Mr. Arthur and his team have assessed integrity of wells of interest, reviewed pressure build-up tests, bubble tests, cement evaluation logs, temperature logs, noise logs, mud logs, various other geophysical logs, LEL

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testing, results of isotopic gas analysis at production wells and water wells, timelines, and performed other analyses. Through the project, he has worked with legal representation

For a Confidential Client with operations in the Fayetteville Shale, Mr. Arthur served as the Project Manager for an effort to assess disposal zone options in Northern Arkansas. The project includes evaluating geology, hydrology, and water quality in zones overlying the Fayetteville Shale for purposes of disposal and/or aquifer storage/recovery. This project is ongoing.

For a Confidential Law Firm, Mr. Arthur is currently serving as a Technical Expert on a stray gas arbitration case in Northeast Pennsylvania. Mr. Arthur completed a holistic well integrity evaluation for the wells in question. This includes evaluating daily drilling reports, mud logs, various pressure build-up tests, timelines, temperature/audio logs, Radial Cement Bond Logs (RCBLs), and various other applicable data. Mr. Arthur then prepared an expert report in preparation for hearing, the Arbitration was held in early 2014.

For a Confidential Client, Mr. Arthur served as the Program Manager for a water accounting analysis project for the Client's assets. The assets involved included operations in the Fayetteville Shale, Haynesville Shale, Eagle Ford Shale, and in the Permian Basin of West Texas. For the project, ALL completed a comprehensive analysis of water accounting, metering, water accounting systems, transportation, reporting, record keeping, classification of water used (e.g., fresh, brackish, and saline), benchmarking among production units, and definition of process utilized. This project served as the first phase of a much larger project that has yet to be implemented.

For a Confidential Client with operations in the Utica Shale of Ohio, Mr. Arthur is the Program Manager for development activities. For this client, ALL Consulting is working on a contract operating basis, handling tasks from site selection and permitting, environmental, drilling, construction, testing, and operation. This has included on conducting tasks related to permitting and regulatory, geology and hydrogeology, water management options, environmental sampling, drilling plans, hydraulic fracturing, emergency response and drilling contingency plans, AFE development, etc. ALL initiated drilling of the first Utica Shale well for the subject client in March 2013.

For a Confidential Client involved in managing produced water for treatment, reuse, and disposal, Mr. Arthur has served as a Co-Project Manager with Greg Casey (ALL Consulting). Activities have included supporting projects in North Dakota, Colorado, and Texas. Projects have involved water treatment systems, recycling facilities, and waste disposal facilities. Included in project activities have been system design and specifications for produced water treatment systems (i.e., including water produced during the flowback process and after wells are in the operations phase).

For a Confidential Client, Mr. Arthur managed a water use study in the North Dakota portion of the Bakken oilfield. The study included contacting a variety of oil & gas companies, service companies, technology providers, and governmental agencies regarding water sourcing, transportation, conditioning, treatment, use and disposal throughout the region. Data and information were compiled and analyzed for a variety of uses and applications.

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For Access Midstream, Mr. Arthur has supported analysis and study of best management practices, rules, violations, and benchmarking for pipeline activities in Marcellus Shale region of Appalachia. This has included assessing compliance and practices used in erosion and sediment control, protection of State Waters, analysis of activities, and environmental impacts.

For **Chesapeake Energy**, Mr. Arthur managed well evaluation and remedial activities as well as regulatory communication/coordination relative to gas wells in northeast Pennsylvania (primarily Bradford County). This included management of activities prescribed as part of a Consent Agreement between Chesapeake and the Pennsylvania Department of Environmental Protection (DEP) as specified in a Corrective Action Plan (CAP) prepared by ALL Consulting under Mr. Arthur's direction. Additionally, Mr. Arthur served as the primary expert on performing well integrity evaluations and determinations on approximately 350 wells in the region. During implementation of the CAP, approximately 3,000 pressure build-up and vent-rate tests, over 250 noise and temperature logs, over 100 Radial Cement Bon Logs, and over 30 well remedial jobs were performed – all under Mr. Arthur's Direction. As part of the effort, several innovations related to well integrity analysis were developed. This was the largest well evaluation and remedial effort of its kind performed anywhere in North America related to wellbore methane intrusion (or Stray Gas).

For a Confidential Client, Mr. Arthur serves as the Client Manager for ALL Consulting's support of the Client's Eagle Ford (EF) development activities. Support activities provided by ALL include:

- **Waste Management:** ALL is assisting in the development of a waste management program for every type of waste generated during the drilling, completion, and operations process. ALL staff are assisting in developing criteria for acceptance of a waste management facility for use by producers and are conducting site inspections to ensure that the companies are compliant and meet relevant criteria.
- **Water Management:** with more than 10 rigs running the in the Eagle Ford, water management planning and plan implementation is critical to Murphy. ALL has been assisting the Client with planning, permitting, design and other aspects of water over the lifecycle of use.
- **Well Pads in Flood Plains:** Although South Texas is dry, there are areas in flood plains and many of the Counties in the EF require permits to assure either that construction will not negatively impact flood capacity or that proper mitigation is incorporated. ALL is assisting in the preparation of the flood plain permit applications.
- **Ground Water Conservation Districts (GWCDs):** Management of groundwater is crucial in the EF. The area has many GWCDs and how the GWCDs are managing groundwater use is changing. ALL is assisting with developing plans, acquiring permits, doing reporting, understanding requirements, and coordinating activities so that they are compliant with District requirements.

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- **Completions:** ALL supported analysis of completion activities (Hydraulic Fracturing), including assessing performance of completion jobs, benchmarking with offset operators, production correlations, process analysis, efficiency analysis, cost analysis, etc.
- **Disposal Wells:** ALL is currently assisting the Client in reducing costs paid for disposal and trucking as well as auditing facilities where Client currently takes wastewater and others that may be more desirable due to proximity or compliance.
- **RRC and Other Permitting:** ALL has had staff working in the Client's office assisting with a variety of permitting and Environment, Health, and Safety (EHS) activities. ALL is also working directly with field staff and assisting in the training of company staff members in Houston. ALL is filling a key role specific to support development of the Eagle Ford Shale.
- **Emergency Response:** ALL has taken the lead on preparing a number of emergency response plans as well as working directly with producers to develop a program that is also compliant with worldwide standards.
- **DOT Pipelines:** As the EF expands, the area is also seeing expansion of pipelines for moving oil and gas. Although much of the area is sparsely populated, many pipelines fall under Department of Transportation (DOT) Pipeline Program regulation. ALL is assisting in making determinations and developing pipeline safety and compliance programs.
- **Chemical Disclosure:** As part of ALL is developing FracFocus, we also have staff assisting the Client understand chemical screening issues and with submittals of information to FracFocus.
- **USACE & Impoundments:** Design and siting an impoundment can be challenging. Several landowners would like new impoundments to be put across creeks or streams and may have lease terms that require the operator to develop an impoundment on their property and also to pay a fee for water usage. Unfortunately, development timelines don't always have time to wait on permitting through the U.S. Army Corps of Engineers (USACE). ALL has had multi-disciplinary teams in the EF assisting with siting, assessment, and permitting. This has been a critical support effort for the Client's development considering the number of rigs they are running.
- **Wildlife Management:** Although South Texas isn't the Rocky Mountains, managing wildlife is still an issue. ALL is assisting with the preparation of wildlife management plans specific to Eagle Ford Shale development operations. These plans can range from developing practices for dealing with discovery of dead animals to effectively managing threatened and endangered (T&E) species.
- **Spill Response:** As it has done in other areas of Texas, ALL is currently serving as the go-to team on spill response. We have only handled multiple spills for the Client in the EF thus far and all were addressed without environmental harm.

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- **Air Permitting/Compliance:** ALL has been assisting with an assortment of air permitting and compliance issues. This has ranged from simple to more complicated issues such as greenhouse gases (GHGs) and addressing company-wide 3rd party audits.
- **Other Miscellaneous:** ALL has a good bit going on in the EF for the Client. We have assisted the Client with pit/pond design, chemical screening/sampling, and consultation on a variety of issues. ALL's services have encompassed all aspects of EHS responsibilities.

For **Apache Corporation** and **TAG Oil**, Mr. Arthur managed a project supporting the first onshore shale development project in New Zealand. For this project, Mr. Arthur and other team members traveled to Napier, New Zealand, to work with local company representatives and other project support personnel preparing permit applications and supporting information for the development project. Furthermore, ALL supported Apache and TAG with various information and analysis related to shale development, including analysis of hydraulic fracturing, induced seismicity, events of concern related to shale development elsewhere in the world, and coordination with government agencies in New Zealand. This also included design of wells, pads, completions, pits/impoundments, and other infrastructure. ALL's role also included working with various technical groups and making recommendations on geology, drilling, completion, water, air, waste management, noise, visual, chemical use, stormwater management, erosion control, traffic, and various other aspects of the development project.

For **Apache Canada**, Mr. Arthur managed a technical support contract for Apache regarding the development of a new shale play in New Brunswick, Canada. Mr. Arthur and others at ALL Consulting supported Apache with a variety of tasks for the project. These ranged from pre-side development planning, pre-drill background sampling and analysis, water management planning, environmental analysis and planning relative to other industrial activity in the area, community relations, preparation of fact sheets and information for public review, consultation with regulatory agencies, preparation of materials for meetings between Apache and regulatory agencies and/or landowner groups, exploratory well consultation, and ultimately site closure tasks due to the play not being deemed economic.

For the **Petroleum Technology Alliance Canada (PTAC)** and the **Science Community and Environmental Knowledge (SCEK)** Fund, Mr. Arthur Served as the Lead Researcher for a study assessing the environmental risks associated with Hydraulic Fracturing. The project was partially funded by the Canadian Association of Petroleum Producers (CAPP) and took a broad look at the injection practice associated with fracturing, from geology and regulatory framework to correlating activities in the United States and review of alleged incidents associated with high volume hydraulic fracturing. Analysis as part of this research included a broad analysis of hydraulic fracturing, that includes reviewing completions in many plays relative to issues such as environmental impacts, impacts to offset or nearby production wells, review of Microseismic monitoring data relative to fracture length, use of radioactive tracers, and other data relative to the performance and impacts of hydraulic fracturing. The study was completed in early 2012 and the final report published after both industry and peer review. The report is available from the PTAC, CAPP, and SCEK web sites, in addition to ALL's web site.

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For the **New Mexico Oil & Gas Association**, Mr. Arthur served as a Technical Expert for hearings held by the New Mexico Oil Conservation Division on proposed changes to the state's Pit Rule. Mr. Arthur provided technical analysis, expert testimony, and consultation to the Association, participating operators, and legal representation. Participating companies included approximately a dozen different producers active in New Mexico. Mr. Arthur also collaborated with other experts who were testifying on soil science and risk to human health. Mr. Arthur's testimony covered an array of issues and served as a key piece of testimony supporting proposed pit rule modifications.

For a Confidential Client in East Texas, Mr. Arthur managed response to a water well contamination complaint and supported a Confidential law firm in the defense of a related law suit. The case occurred over a period of approximately 18 months. As part of the project, ALL conducted multiple water and isotopic gas samplings at water and gas wells. ALL also conducted mechanical integrity testing on alleged gas wells of concern and did substantial research in the area related to groundwater quality, water chemistry, geology/hydrogeology, methane from area Lignites, historic presence of naturally occurring shallow system gas, etc. After substantial testing, the Railroad Commission (RRC) concurred with ALL's argument that the issue was not a result of gas drilling or stimulation activity.

For **Newalta Corporation**, Mr. Arthur managed an effort by ALL to support Newalta in assessing the feasibility of new salt water disposal (SWD) sites in the Marcellus, Utica, Eagle Ford, and Bakken shale plays. This included evaluating geology, underground sources of drinking water, well drilling and facility costs, existing facilities, potential disposal volumes, transportation, and other issues. For the Eagle Ford area, ALL has also analyzed requirements for both mobile and stationary water treatment facilities in addition to SWDs and related facilities, conducted facility design and permitting, and other tasks related to implementation of wastewater and waste recycling.

For **Triana Energy**, Mr. Arthur managed multiple projects for Triana's activities throughout Appalachia. This has included conducting a multi-company well cost benchmarking study, supporting technical analysis of well stimulation technology, and other activities related to water and environmental matters. ALL also supported Triana in review of data in Romania, including proposed drilling and completion requirements.

For **Whitehawk Environmental Services**, Mr. Arthur has provided technical support on a project by ALL Consulting for the permitting and development of commercial disposal facilities in both the Bakken and Eagle Ford Plays. This has included coordinating with the client on various issues related to disposal well permitting, coordination with leases and landowners, assessment of issues (e.g., induced seismicity, well construction and completion, etc.). Mr. Arthur serves as the Co-Project Manager on this project with Greg Casey (ALL Consulting).

For **EagleOne**, a trucking company headquartered in Ft. Smith, Arkansas, Mr. Arthur has managed an ALL project to assist EagleOne in evaluating the possibility of adding a new service involving water treatment. The confidential treatment technology provided the ability to remove

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bacteria from produced water in advance of use for hydraulic fracturing. Mr. Arthur managed the project to assist EagleOne evaluate the technology and potential use.

For multiple companies that either have had or had acquired water treatment technologies, Mr. Arthur served as a project manager in assisting these companies in evaluating the subject technologies and deciding what areas of the country to pursue to help them understand how water treatment services are contracted by oil & gas companies, as well as other miscellaneous tasks.

For **Newfield Exploration**, Mr. Arthur has provided technical support for development activity in Oklahoma. This has included managing pre-drill sampling efforts along with other miscellaneous tasks including data analysis, landowner coordination, and coordination with Newfield Staff.

For **Allete, Inc.**, Mr. Arthur managed a market survey and analysis conducted by ALL for a prospective acquisition by Allete. The acquisition was for a chemical supply company having intentions on expanding its business to serve the oil & gas industry. As such, ALL reviewed competitors, economics, and methods by which the company might enter this new sector. Further, ALL reviewed information provided by the chemical company relative to their plans for entering the market. Mr. Arthur presented results to Allete's Executive Management Team and provided considerable insights on how the shale gas & oil industry operates through this process.

For **K&L Gates**, Mr. Arthur managed an effort to support K&L Gates and **Atlas Energy** with issues at a development area in Washington County, Pennsylvania. As part of this effort, Mr. Arthur managed field investigation activities, data analysis, and review of materials prepared by other consultants, and assessed well drilling/completion and site development activities performed by Atlas. This information was provided as an Expert Report as part of litigation between Atlas and the Landowner. Based on the analysis conducted by ALL, Mr. Arthur's Expert Report, and other information, the case settled.

For **TAG Oil**, Mr. Arthur managed ALL's activities to support TAG for oil development in New Zealand on the western portion of the Northern Island. This included evaluating technical and development data for the project, and providing TAG with input on analysis and data presentation.

For a coalition of companies with lease acreage in the Delaware River Basin, Mr. Arthur managed a project geared toward working with the Delaware River Basin Commission (DRBC) on their rule-making for Marcellus Shale development. The companies involved included **Chesapeake Energy**, **Hess Corporation**, **Newfield Exploration**, and **XTO-Exxon**. Additionally, work was coordinated with the Marcellus Shale Coalition and the American Petroleum Institute. Through the process, multiple meetings were held with industry members and with the DRBC. During meetings with the DRBC, Mr. Arthur provided technical discussion on proposed rules, technical analysis conducted by ALL Consulting on the rules, and on Marcellus Shale development processes. The effort was concluded with a technical document prepared by ALL Consulting making recommendations relative to the proposed rule. The document is available from the DRBC's website and ALL's website.

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For **Enduro Energy Resources**, Mr. Arthur as served as a Senior Consultant on a variety of projects in New Mexico, Texas, Wyoming, Louisiana, and North Dakota. Activities performed by Mr. Arthur have varied from advising Enduro on non-operated activities in New Mexico and Louisiana to addressing acquisitions in Wyoming and North Dakota. Issues have included wetlands, air, waste, water management, gas plant activities, and soil remediation, among others. ALL Consulting serves as Enduro's Environmental Consultant and has worked with Enduro staff since Enduro's President (Jonny Brumley) was with Encore Acquisition, where Mr. Arthur also managed environmental matters starting in approximately 1997.

For **Hess Corporation**, ALL Consulting has conducted several projects in areas such as the Eagle Ford, Marcellus, Utica, and Bakken Shale Plays, and internationally in Australia. These projects have included supporting Hess with stray gas issues in the Marcellus and conducting a detailed water study in the Eagle Ford—specifically in the portion of the Eagle Ford where Hess has acreage. Mr. Arthur managed all the work conducted for Hess by ALL Consulting, including work on hydraulic fracturing chemical disclosure, sampling & analysis of produced water, evaluation of SWD alternatives, environmental auditing, environmental assessments, pre-drill sampling & assessments, regulatory analysis, and various other activities.

For **Continental Resources**, Mr. Arthur has served as both Project Manager and Senior Consultant on a variety of projects, primarily located in the Williston Basin of Montana and North Dakota, but also in areas such as Wyoming, Louisiana, Oklahoma, Michigan, and New York. Mr. Arthur has managed tasks regarding regulatory and issue analysis (e.g., water sourcing, induced seismicity, Bureau of Land Management [BLM] permitting challenges, etc.) and has supported other ALL projects in a Senior Consultant and technical review capacity. This has included well permitting; air issues; environmental auditing; regulatory analysis; drilling & completion analysis; production operations analysis; permitting time & cost evaluations (in New York); Stormwater permits; Spill Prevention, Control and Countermeasure (SPCC) plan development/review; environmental analysis as part of Continental's IPO; and a variety of other tasks and issues. Continental Resources has been a client of ALL's since 2004.

For **Silver Oak Resources**, Mr. Arthur has managed a variety of environmental projects for areas acquired and operated by Silver Oak. This has including supporting Silver Oak with environmental due diligence on new acquisitions and preparation of SPCC plans. Through this process, Mr. Arthur and ALL coordinated with the client and field personnel to address issues identified and meet client requirements.

For multiple clients in Northeast Pennsylvania, Mr. Arthur has managed projects related to wellbore gas intrusion. Activities have included well testing and analysis, sampling, installation of post-completion well caps to facilitate pressure monitoring on annular spaces previously not having a contained annular space, and miscellaneous site work. This has included coordinating with landowners in the area, operations personnel, state regulatory agencies, and contractors to dig out well cellars for cap installations, temperature & noise logging, log evaluation, and evaluation of casing & cementing practices.

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Mr. Arthur has served as the Principal Investigator on three (3) research projects related to water. Two of the projects focused on shale gas water issues, including lifecycle water management in the Marcellus shale, water pre-treatment and post production treatment, cumulative impact analysis, shallow system naturally occurring natural gas analysis, and various related issues. The third project relates involves investigation of alternate water supplies for coal-fired power plants and the development of an on-line tool to be used by the power industry for researching alternative water supplies.

For a confidential law firm, Mr. Arthur has managed projects concerning shallow system naturally occurring methane and related alleged impacts to shallow groundwater and hydrogeological systems. Further, Mr. Arthur assessed and coordinated detailed analysis of testing, well completions, remedial activities, assessment activities, and planning. This has included evaluation of well completions (existing and proposed) in northeastern Pennsylvania and in both the Susquehanna River Basin and the Delaware River Basin.

For a confidential gas developer in East Texas, Mr. Arthur has managed an assortment of projects, including management of all environmental requirements for the company on a contract basis. This has included monitoring and evaluating new regulations, regulatory and government affairs activities, permitting & compliance activities, design of well pads and for environmental related projects (e.g., mitigation controls, pipeline crossings, injection wells, etc.), compliance testing (e.g., engine testing), emergency response, pipeline/safety, and other miscellaneous related activities.

For Southwestern Energy, Mr. Arthur has served as the Program Manager for various activities in the Fayetteville Shale of Arkansas. This has included permitting, evaluation of water and water treatment technologies, development of best management practices for handling and management of produced water, support for impoundment siting/design/permitting, and regulatory evaluation. Mr. Arthur has providing consultation on several issues for development of the Fayetteville Shale.

For Apache Canada, Mr. Arthur served as the Project Manager and lead in an effort to provide environmental support and consultation regarding shale gas development in various regions of Canada. Mr. Arthur provided multiple training workshops to Apache Canada staff as wells as governmental staff from New Brunswick. This included review of the broad spectrum of environmental allegations gaining press in the United States related to shale gas development in plays such as the Marcellus, Fayetteville, Haynesville, Barnett, Woodford, Eagle-Ford, Collingwood, and Utica.

For a confidential client, Mr. Arthur has supported research and evaluation related to the possibility of injection induced seismicity for injection wells. Research on induced seismicity has encompassed North America and all known induced seismic events, including alleged cases resulting from enhanced oil recovery (e.g., waterflooding), geothermal wells, solution mining wells, brine disposal wells, hazardous/industrial waste disposal wells, and CO2 Sequestration wells. Analysis has included case study evaluation, pressure and geological analysis, volumetric analysis, zone of endangering influenced analysis and modeling, well test analysis, statistical and probability analysis, and other technical analyses.

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Mr. Arthur has been working with the Horn River Basin Producers Group (HRBPG) to provide general support/guidance and information related to public communications efforts for shale gas development in the Horn River Basin of northeastern British Columbia. For example, Mr. Arthur assisted with materials related to water use details in the basin, ranging from surface water use to saline groundwater supplies requiring treatment.

In 2009-2010, Mr. Arthur managed projects for several services companies seeking to enter into or expand their support to the unconventional gas industry. Further, some projects in this mix of clients included advising companies on improving the environmental nature of their business. This included trucking companies, railroads, water treatment companies, large integrated service companies, investment and marketing groups, and technology developers.

For Energy Corporation of America, Mr. Arthur provided assistance related to the permitting of brine disposal wells in Pennsylvania and West Virginia. This included evaluating potential sites, disposal zones and capacities, wells that could be converted, and well testing performed, and preparing materials for submittal to the U.S. Environmental Protection Agency.

For the Independent Oil & Gas Association of New York, Mr. Arthur served as the Program Manager for an extensive effort of coordinating industry input and response to the New York Department of Environmental Conservation on the New York Supplemental General Environmental Impact Statement. This has included coordination of a multi-disciplinary team within ALL Consulting and coordination of input from several different industry participants.

For the Arkansas Oil & Gas Commission, Mr. Arthur has provided support and technical review of injection well permitting for brine disposal activities in the Fayetteville Shale of northern Arkansas. This has included review of permitting procedures, review of permits, and preparation of comments and recommendations on future permitting.

For a confidential energy client, Mr. Arthur is currently providing guidance and support relative to development of the Utica Shale, coal bed methane, and conventional gas in the Northeastern United States. This has included well evaluations relative to current and historic production activities, evaluation of potential development of coal bed methane and shale gas, and expansion of existing conventional gas throughout the area of interest.

For a large confidential Canadian Energy company, Mr. Arthur managed an effort to assist with evaluation of various shale plays in the United States, including detailed review of environmental issues, environmental laws and regulations, standard practices, water sourcing and disposal, horizontal drilling technologies, technologies and practices used for hydraulic fracturing, operational/development challenges, and other details. This included all of the major shale plays in the United States as well as emerging and developing plays.

Mr. Arthur has served as the Project Manager for a project performed for the Domestic Energy Producers Alliance (DEPA). DEPA is a new organization headed by Mickey Thompson (formerly Oklahoma Independent Petroleum Association (OIPA) Executive Director) along with Harold Hamm (Continental Resources) and others. ALL is assisting DEPA in evaluating issues related to prices Oklahoma producers are getting for crude oil, pipeline limitations/issues, and other factors.

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This includes updating an economic analysis performed by ALL for the Northern Alliance of Independent Producers (NAIP), for which Mr. Arthur was the Project manager.

For multiple energy industry exploration and production clients, Mr. Arthur has managed and technically supported a variety of projects. These have included supporting leasing activities, environmental assessments as part of property acquisitions, all types of permitting applicable to oil & gas operations, compliance support, support specific to enforcement actions, expert testimony, plan development (e.g., SPCC), environmental reporting (e.g., Tier II, Community Right-to-Know, permit reporting, etc.), emergency response, pit closures, impoundment and landfill design/siting, injection well design/permitting, water management and handling, hydraulic fracturing issues, regulatory and government affairs, training, federal requirement support (e.g., paying well determinations, federal exploratory units, etc.), coordination with state and federal agencies (e.g., OCC, BIA, BLM, USACE, MMS, etc.), wetlands delineation/permitting, archeological survey/clearances, ROWs, stormwater management/erosion control, production optimization, cost engineering, facilities design, NEPA and state environmental policy act support, along with support of many other issues. Mr. Arthur is a recognized authority in many areas has experience in every oil & gas producing state throughout the United States.

For multiple confidential coal bed natural gas (CBNG) and unconventional gas developers, Mr. Arthur serves or has served as the Project and Client Manager for services provided by ALL Consulting. Work performed has included support of development activities in Arkansas, Colorado, Kentucky, Louisiana, Maryland, Montana, New Mexico, New York, Ohio, Pennsylvania, Wyoming, Texas, Louisiana, Oklahoma, Illinois, Michigan, Virginia, West Virginia, and outside the United States. Mr. Arthur has managed and supported the preparation of Plans of Development (PODs); cradle-to-grave project cost analysis (including both capital and operational costs); permit applications; training; DOT pipeline compliance; economic and alternative analysis (including use of Monte Carlo simulation and other LCA modeling); water management planning/implementation/analysis; regulatory planning efforts; financial planning; MEPA/NEPA/SEQRA issues; engineering design; water treatment planning; expert testimony; and other issues relative to development activities. This has also included specification/design/management of "all" surface equipment (e.g., compressors, physical metering, well head configurations, etc.), "all" subsurface activities/equipment (e.g., well drilling, tubulars, stimulation, etc.), and all other applicable contracts and/or decision processes.

Mr. Arthur managed a U.S. Department of Energy (DOE) research project involving the preparation of a Primer on shale gas development throughout the United States. The project involved analysis of natural gas supplies, the regulatory framework applicable to the oil & gas industry, geology and development approaches applicable to shale gas, and research related to a broad array of environmental issues. The environmental review included research on issues such as horizontal drilling, hydraulic fracturing, water sourcing, water management, water treatment/disposal, and other issues and impacts pertaining to issues such as transportation, wildlife, stormwater, underground injection, noise, visual impacts, drilling in rural versus metropolitan areas, etc.

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For a confidential developer in Michigan, Mr. Arthur has provided and continues to provide both environmental and operational support on development of both conventional and unconventional resources. The project includes development of heavy oil, shale gas from the Antrim/New Albany Shale, and conventional oil development. Mr. Arthur has supported efforts working with both state and federal agencies, landowners, and production operations staff. This work is ongoing.

Mr. Arthur currently manages services provided by ALL to the largest and most active natural gas developer in the United States. Services have ranged from basic environmental permitting to high-level consultation to upper management on environmental, water sourcing, and water management/disposal issues (including water characterization, transport and treatment) for operations in 22 states. Unconventional natural gas development has been a priority and has included analysis of all aspects of operations, especially those related to water. This has included water sourcing, transport, surface handling, hydraulic fracturing, gas and water production, handling of produced water, water treatment alternative analysis, analysis of municipal and third-party water treatment companies, deep injection of produced water, cost analysis, related regulatory analysis, and a variety of related research. Significant work was also performed by Mr. Arthur and under his direction with regard to hydraulic fracturing, including design analysis, water and wastewater handling, water and chemical management, environmental impact/threat analysis, etc.

Mr. Arthur is currently the Principal Investigator on a DOE-funded research project involving water treatment technology analysis and selection for use in the oil & gas industry for produced water. The project involves analysis of various treatment and beneficial use alternatives, development of a detailed catalog of produced water treatment technologies, and development of a model for use in identifying applicable treatment systems for a given quantity/quality of water and area. The project is being done in collaboration with the Ground Water Protection Council and several State Regulatory Agencies in various parts of the United States, including the Rocky Mountain and Appalachian States.

Mr. Arthur has managed a technical support contract with the U.S. Department of Energy's National Energy Technology Laboratory (NETL) in Tulsa, Oklahoma, and Morgantown, West Virginia. Through this contract, ALL has performed multiple projects, including research relative to frontier and emerging unconventional gas development, stormwater regulations relative to the upstream oil & gas industry, produced water reduction methods, feasibility studies, TMDL modeling, well completion technology, naturally occurring radioactive materials (NORM), and other technical support projects.

Mr. Arthur has managed research which studied CBNG impoundments in the Powder River Basin of Montana and Wyoming. ALL's co-researchers include the Montana Board of Oil & Gas Conservation (MBOGC), the Wyoming Department of Environmental Quality (WDEQ), DOE NETL (Morgantown, West Virginia, and Pittsburgh, Pennsylvania), and the BLM.

In the active area of East Texas and Louisiana, Mr. Arthur has and continues to manage ALL's support of environmental and operational issues for active drilling programs for multiple confidential companies. Work has primarily been for gas development and has included both

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conventional and unconventional gas plays. This work includes serving as the environmental staff for smaller companies that do not maintain environmental or regulatory staff. Work has included wetland delineation studies, air permitting, SPCC plan development, emergency response for spills and unintentional releases, pipeline permitting, environmental due diligence on new acquisitions, Tier II reporting, injection well permitting and compliance, environmental auditing, and interfacing with local government agencies as well as with river authorities and various regulatory agencies. Mr. Arthur has conducted stormwater surveys, evaluated water resources, and laid out and designed well pads where necessary. Work in this area has essentially included a variety of tasks that were required for drilling and operational activities to move forward without delay.

Mr. Arthur currently serves as the lead technology expert on a U.S. Department of Energy Research effort involving water resources, water treatment, and produced water. The project involves assessing unconventional water supply alternatives for coal-fired power plants and coal mines on a national basis. This includes assessing water treatment alternatives, impacts to water resources, and regulatory barriers.

For a confidential large international Oil & Gas company, Mr. Arthur managed and worked with company staff on a variety of issues pertaining to unconventional gas development on a worldwide basis. This included cost engineering on a comprehensive basis and all components of a large development project, including operations, staffing, equipment selection, engineering/design practices, and optimization. Additionally, Mr. Arthur and a select team from ALL supported the company on issues such as water supply, water management, water treatment analysis/selection, wastewater disposal, regulatory analysis, equipment acquisition and leasing, vendor evaluations, safety considerations, and alignment with various company standards. Work involved projects in the United States and in several different countries that included areas of the Rocky Mountains, jungle environments, and remote areas of other countries having minimal infrastructure for oil or gas development.

Mr. Arthur provides technical support to multiple companies that provide or are seeking to provide water treatment or commercial water handling of produced water. This has included treatment methods such as ion exchange, electrodialysis/electrodialysis reversal, electrocoagulation, reverse osmosis, floatation, and others. This has included addressing issues involving design, operation, compliance, engineering, and other aspects of treatment alternatives.

Mr. Arthur manages and provides senior consulting to ALL's work in the Cherokee Basin specific to unconventional gas development, primarily involving coal bed natural gas development. This work has included supporting and advising clients on environmental, engineering and operations issues, including DOT pipeline requirements.

For the Montana Department of Natural Resources and Conservation (MDNRC), Mr. Arthur managed a data management project to develop a new comprehensive system to facilitate the management of data maintained by the MDNRC's Trust Land Management Division (TLMD). The project was completed in approximately two (2) years and the system is currently utilized by the TLMD. The system addressed all areas of the TLMD's responsibilities and provided Mr.

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Arthur with an opportunity to gain a detailed understanding of how the TLMD functions. As part of this project, Mr. Arthur managed a multi-disciplinary team to address all resources managed by the TLMD, including oil & gas, mining, agriculture, recreation, etc.

Mr. Arthur currently serves as the Project Manager and Lead Engineer on an assortment of projects involving oil & gas operations in Wyoming, including a broad range of operations from large historic fields having nearly 100 years of operations to smaller less established areas. Due to the significant federal land and minerals in Wyoming, much of this work has involved coordination with many BLM field offices, BLM's State office, and other federal agencies as well as a myriad of state and local governmental and non-governmental organizations. Mr. Arthur's work has included collaborative research with the State of Wyoming's Governor's Office, the Wyoming Oil & Gas Conservation Commission, the Wyoming Department of Environmental Quality, the BLM, and dozens of oil & gas producing companies having operations in Wyoming. His experience includes work in areas such as the Greater Green River Basin, Elk Basin, Powder River Basin, and others. Some of the projects Mr. Arthur has been involved in include, but are not limited to, environmental assessments, plant decommissioning, site closure and reclamation, site remediation, permitting, environmental planning, engineering evaluations, design engineering, interfacing with various governmental entities, and more. Mr. Arthur is well versed in federal oil & gas and related resource management and environmental issues throughout Wyoming and is expert with regard to the National Environmental Policy Act (NEPA).

While working in Oklahoma for an independent oil and gas producing company, Mr. Arthur was involved in many aspects of drilling, completion, and production operations for both production and injection wells throughout Oklahoma and northern Texas. In this position, he provided resident engineering services during design, drilling, construction, and acid stimulation of many potential production wells ranging from approximately 6,000 feet to approximately 11,000 feet in total depth. He also performed injection well feasibility studies, economic evaluations, well workover designs, reservoir calculations, and reserve estimates. He worked with numerous equipment vendors and suppliers of current technologies.

Mr. Arthur has continued to manage environmental projects provided to confidential oil & gas developers throughout the country. Projects have included preparation of SPCC plans, stormwater data collection and permitting, environmental audits, site reclamation evaluation and waste management; litigation support; acquisition support; environmental planning; environmental permitting; preparation of applications for permit to drill; preparation of development plans; preparation of paying well determinations and participating area expansions; leasing support; exploration and exploitation support; water management; federal access; expert testimony; support of location exceptions and spacing; support of water rights issues; NEPA support; and other tasks.

For the Ground Water Protection Council, DOE, and BLM, Mr. Arthur managed a feasibility study which investigated alternatives for beneficially using produced water from CBNG development in the western states. An emphasis was placed on a five-state region, which included Montana, Wyoming, Colorado, Utah, and New Mexico. Through this study, water management and treatment alternatives were investigated in the field and multiple case studies were prepared.

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Further, regulatory and water rights issues were evaluated in cooperation with relevant local, state, and federal agencies. A guidebook was prepared as a result of the project and serves as key reference for water management planning for CBNG development.

Mr. Arthur also worked for Halliburton Services in Oklahoma City, Oklahoma. While serving at Halliburton, he became familiar with standard and innovative well cementing practices and was involved in acid stimulations, well pressure transient and hydraulic testing, and formation isolation, fracturing, and stimulation projects on approximately 300 wells.

Since 1999, Mr. Arthur has managed numerous projects and serves as the "Key Consultant" for a Consulting Services Agreement between ALL Consulting and Encore Acquisition Partners (www.encoreacq.com), an independent oil and gas producing company based in Ft. Worth, Texas. Through ALL Consulting's relationship with Encore, the firm has provided an assortment of services, which include acquisition support, environmental permitting and compliance work, data management, reserve analysis and production certifications for tax incentive programs, remediation, waste management and remediation, and other miscellaneous activities as necessary. These services have been provided for all of Encore's properties with work occurring in several states and in Canada. Furthermore, Mr. Arthur has supported Encore with a variety of marketing and new venture projects. Mr. Arthur served as the Project Manager for all of the work provided by ALL Consulting to Encore.

For a commercial waste management company in the Williston Basin, Mr. Arthur served as the Project Manager and primary technical consultant supporting regulatory compliance, site closure, identification of a new site, and support of business operational practices. This has included technical evaluation of oilfield waste management and bioremediation practices. Mr. Arthur provided high-level business management consultation to the company's management and assisted with legal issues facing the company.

For a large multi-national energy company, Mr. Arthur provided project management and consultation for business operations and environmental planning for CBNG development activities in the Powder River Basin of Wyoming, including development in the Big George Coal. Additionally, Mr. Arthur managed the preparation and presentation of a detailed workshop concerning CBNG activities and challenges in the Wyoming portion of the Powder River Basin.

For the American Petroleum Institute, Mr. Arthur managed the planning, coordination, and presentation of a national workshop on CBNG development nationally. The workshop was structured to attract attendees from across the nation and include speakers from government and industry addressing key issues facing the energy industry. Access to federal lands; regulatory challenges, and technical hurdles were key aspects of the workshop.

Mr. Arthur served as the Project Manager and Senior Technical Consultant for a statewide Oil and Gas/Coal Bed Methane Environmental Impact Statement and Resource Management Plan Amendment in the state of Montana. The project was done for the BLM and the State of Montana through a direct contract between ALL and the BLM. As the Project Manager, Mr. Arthur managed a team of more than twenty (20) technical specialists and coordinated with dozens of technologists and regulatory specialists throughout Montana and in the federal government. The

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final plan was issued in 2003 and ALL Consulting met every deadline for the project. The plan was heavily litigated and found to be technically adequate through 16 separate court judgments. Mr. Arthur has also made dozens of presentations and coordinated with Native American Tribes (Northern Cheyenne and Crow), various federal agencies, irrigators, ranchers, oil and gas producers, regulatory officials, and others through this process on a broad variety of technical issues. The overall cost of the project exceeded \$1 million.

For the Bureau of Land Management, Mr. Arthur serves as a Senior Technical Consultant and Project Director for the preparation of a Resource Management Plan for the Miles City RMP area. The project encompasses a variety of resource issues for what is essentially the eastern third of Montana. Mr. Arthur's role in the project included project management support, technical and planning advising to the project team and BLM, and staffing and scheduling project support. This project has included analysis of coal resources and evaluation of options for either shipping coal outside the state or generating power locally and transporting electricity via power lines. The current costs for this project are approximately \$1.5 million.

For the Bureau of Land Management, Mr. Arthur served as a Senior Technical Consultant and Project Director for the Supplemental Environmental Impact Statement (SEIS) to the Statewide plan previously completed by ALL in 2003. The SEIS is a comprehensive plan addressing a broad range of resource areas and further addressing issues such as phased development, wildlife, water resources, and air quality in particular detail. The project included regional air modeling and coordination with dozens of state and federal agencies as well as non-governmental agencies, Native American Tribes, industry, and the general public. Because CBNG development has been stalled until this plan can be completed, it has been done on an accelerated schedule and required above average planning and coordination among all involved. The current costs for this project exceed \$1.7 million.

For the U.S. Department of Energy, Mr. Arthur served as the Project Manager for a project to evaluate stormwater management practices specific to the oil & gas exploration & production (E&P) industry on a national basis and support efforts to derail U.S. EPA plans to increase the stringency of this program. The project was coordinated with E&P industry organizations, such as the American Petroleum Institute and the Independent Producers Association of America, and several state regulatory agencies. The project involved review and compilation of stormwater management rules and practices on a national basis, documents relevant to stormwater and the management and prevention of siltation to surface waters resulting from construction practices. An additional and critical component of the project involved ALL coordinating and leading a field tour of oil & gas operations and construction practices in the mid-continent for the U.S. EPA staffers leading EPA's efforts on their stormwater program. This project played an instrumental role eliminating federal stormwater requirements for the E&P industry.

For the U.S. Department of Energy, ALL Consulting supported two (2) separate projects supporting the United States's Annex III Agreement with China as pertains to the development of coal bed natural gas in the two countries. For these projects, ALL Consulting led a presentation on coal bed natural gas development activities in the United States on issues including environmental, drilling, completion, exploration, regulatory, and others to a contingency of approximately thirty

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(30) Chinese Officials. The presentation was made in Washington, D.C., at the DOE's Office of Fossil Energy's Headquarters office. ALL also conducted a field tour for the Chinese contingency of CBNG development areas in the Powder River Basin and San Juan Basin. Most recently, Mr. Arthur and Dr. Bruce Langhus (also of ALL Consulting) prepared and presented a workshop in China on a variety of CBNG and coal mine methane issues, including exploration, equipment design and selection, drilling, production operations, and other relevant technical issues.

Mr. Arthur serves as the Lead Researcher on three (3) separate research projects in association with the Interstate Oil & Gas Compact Commission (IOGCC). The projects are primarily funded by the U.S. Department of Energy's National Energy Technology Laboratory (NETL). The projects included evaluation of produced water management technologies associated with onshore oil & gas development; access to federal lands; and further developing methods for lessening impacts specific to natural gas and oil development. These projects included collaboration with dozens of local, state, and federal agencies; energy companies; and non-governmental organizations.

For Shell Western E&P, Inc. (SWEPI), Mr. Arthur managed a large project for major oil producing field in the Rocky Mountain Region of the United States. The project generally involved petitioning the U.S. EPA for a regulatory exemption for SWEPI's operations. The project's goal was to eliminate or substantially reduce regulatory requirements, including monitoring and area of review requirements applicable to approximately 280 Class II injection wells and several hundred oil and gas producing wells. Another goal of the project was to substantially reduce review and issuance times on injection well-related permits. Mr. Arthur's role in the project was to serve as a primary negotiator with regulators and assist SWEPI personnel in the preparation of the petition. Petition preparation included the review and analysis of several hundred drill stem tests, geophysical logs, various maps and reports, and interviews with a variety of personnel experienced with the hydrogeological setting in the area. Furthermore, numerous tasks were required for the petition, including generating more than 100 maps of various types, performing statistical analyses, and detailed geologic and hydrogeological analyses.

Also for SWEPI, Mr. Arthur managed a project to petition the EPA to decrease unnecessary regulatory requirements for the operation of approximately sixty (60) Class II injection wells operated by SWEPI in Michigan. As part of this project, Mr. Arthur held negotiations and numerous discussions with EPA staff in Region V as well as representatives from the Michigan Geological Survey. Regulatory reduction areas targeted by the petition included requests to reduce monitoring and reporting requirements for active wells, to reduce and modify monitoring, reporting, and testing requirements for idle/shut-in wells, and to eliminate unnecessary injectate analyses and other minor requirements that provided no environmental benefit. The project also included developing an electronic data management system to facilitate data storage and analysis, which could also be used by SWEPI to automatically perform required EPA reporting and track potential non-compliance activities. Mr. Arthur has also assisted SWEPI on regulatory cost reduction efforts in California, Texas, Louisiana, and Montana.

For a confidential industrial client in northwest Michigan, Mr. Arthur provided reservoir management and well services. The industrial operation involved the production of mineral laden brine, which is stripped of select minerals. The resultant stripped brine is then re-injected into the

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source reservoir to enhance brine recovery rates. As part of this project, Mr. Arthur provided assistance in managing the operation of the reservoir, providing efficiency analyses, performing prediction analyses pertaining to the expected life of production wells, and evaluating reservoir fluid levels to assure protection of underground sources of drinking water. This project also included evaluation of dilapidated nearby wells that may be within the area of endangering influence and the use of sophisticated modeling to perform long-term analyses to allow for plant financial planning.

For the Montana Petroleum Association, which is composed of oil and gas companies operating in Montana and includes Shell Western E&P, Inc., Meridian Oil Company, JN Oil Company and is part of the Rocky Mountain Oil & Gas Association, Mr. Arthur managed a project involving the successful pursuit of gaining primary regulatory authority over the Class II UIC program by the Montana Board of Oil and Gas Conservation (MBOGC). This project involved review of primacy application efforts at various states throughout the country, preparation of the primacy application, coordination with MBOGC staff and Board members, and negotiation with EPA personnel on behalf of the MBOGC in regards to primacy delegation. Included in the primacy application effort was the development of a Class II Underground Injection Control Program, which was used to satisfy Section 1425 of the Safe Drinking Water Act. As a result of Mr. Arthur's efforts on this project, the MBOGC successfully obtained Class II UIC primacy in November of 1996.

Through a direct contract with the Kansas Corporation Commission's (KCC's) Oil & Gas Conservation Division (OGCD), Mr. Arthur has provided assistance with an effort by the state to migrate the various databases maintained by the KCC to the Risk Based Data Management System (RBDMS). This project has included training, system setup, data handling and reformatting, data translation, and data migration. The RBDMS program used by the KCC was developed by ALL Consulting as a PC-Based comprehensive fully-relational, normalized electronic data management system designed for oil and gas state regulatory agencies and industry. Twenty state agencies and assorted private industry groups currently rely on RBDMS to maintain oil and gas and associated injection well data. Mr. Arthur has worked on similar projects in virtually every oil and gas producing state throughout the United States.

For a confidential major oil and gas producing company, Mr. Arthur provided engineering and regulatory support of a proposed aquifer exemption on Alaska's North Slope. Mr. Arthur's role in the project included reviewing engineering and hydrogeological studies and data pertaining to the exemption of aquifers to facilitate disposal of wastewater via Class I injection wells. He also provided regulatory guidance on pursuing and obtaining the exemption, preparing the exemption petition, and related construction and permitting of proposed injection wells.

For a major oil company, Mr. Arthur conducted an investigative study to determine the feasibility of potential salt water disposal options for a proposed coal bed methane extraction field in Alabama. During construction of a pilot well, the targeted injection zone was found to have formation water with total dissolved solids (TDS) concentrations of approximately 1,800 mg/l at a depth of nearly 10,000 feet. As a result of the low TDS concentrations in the proposed injection zone, the potential feasibility of utilizing the zone if exempted and the feasibility of petitioning the

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EPA for an aquifer exemption were evaluated. The evaluation resulted in additional pilot wells being drilled to confirm the project's feasibility.

For the Solution Mining Research Institute (SMRI), Mr. Arthur managed a research project pertaining to external mechanical integrity (EMI) testing of Class III salt solution mining wells. The project was divided into three phases, including performing a detailed literature search and information review (including previously performed tests); developing and EMI testing a manual for use by well operators and regulatory agencies; and presenting the manual to the SMRI membership. The manual provided information and guidance on how to prepare and select testing methods; quality control standards and specifications; listings of necessary background and well construction information; procedural standards for various tests; recommended methodologies for interpreting/evaluating tests; advantages, disadvantages, and limitations of tests; and regulatory testing requirements or guidelines. The manual also included details on numerous testing methods, including information on similar logging tools offered by different logging companies.

For a confidential client in Arkansas, Mr. Arthur coordinated the plugging and abandonment of approximately 60 abandoned wells in the state. Mr. Arthur served as technical expert and provided testimony to the State of Arkansas on abandonment procedures and successfully achieved obtaining a variance on plugging procedures, which has resulted in substantial savings to the client and has not sacrificed any environmental protection concerns. Mr. Arthur also served as lead investigator and designer for investigative activities, which included performing a detailed geophysical investigation of the area and designing well plugging procedures.

For a major salt mining and manufacturing company, Mr. Arthur developed and modified a new approach for external MI testing for 5 Class III salt solution-mining wells in St. Clair, Michigan. The new (or modified) testing program was developed to account for the unique nature of some of the Class III wells that had been completed into a salt cavern and utilized as both injectors and producers. The testing included the use of a single pass temperature log under static well conditions and compared the resultant log to temperature logs collected from nearby wells to assure thermal stabilization at tested wells had occurred, to assist in the external MI interpretation, and to assist in resolving lithologic and hydrogeologic effects predominant in the area. Comparisons were performed in area wells having multi-pass and single-pass temperatures with varying stabilization periods and on wells completed with and without tubing. A detailed hydrogeological evaluation was also done to establish how temperature logs would be affected by the local geology and hydrogeology at the site. EPA in Region V approved the methodology, procedures, and test results.

For the Ground Water Protection Council, Mr. Arthur presented several workshops and demonstrations pertaining to the RBDMS project as part of an aggressive technology transfer initiative. Workshops ranged from being very brief (a few hours) to multiple days and were given to state, federal, and private industry representatives. The presentations and workshops provided under this project have included the American Petroleum Institute; U.S. Department of Energy; U.S. Environmental Protection Agency; Bureau of Land Management; U.S. Geological Survey; Alaska Oil & Gas Conservation Commission; Arkansas Oil & Gas Commission; California Division

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of Oil, Gas, and Geothermal Resources; Mississippi State Oil & Gas Board; Montana Board of Oil & Gas Conservation; Ohio Department of Natural Resources; Texas Railroad Commission; New Mexico Oil Conservation Commission; Oklahoma Corporation Commission; Kansas Corporation Commission; and numerous oil and gas producing companies (majors and independents).

For a confidential client, Mr. Arthur completed a full-scale evaluation and assessment of a Class I hazardous waste injection well system in northwest Indiana. The effort included review and evaluation of the facilities hazardous waste land ban petition (including modeling), well construction details and records, long-term monitoring data, well workover data and reports (including those related to well failures), mechanical integrity tests, injection well permits, and related and technical publications and literature. Mr. Arthur also provided estimates for long-term operating costs of the well system (including the potential for well replacement costs), including preparation of plans should any particular well go out of service.

For a large industrial client in the southeastern portion of the United States, Mr. Arthur provided engineering and regulatory assistance in support of a proposed major aquifer exemption for a Class I industrial waste injection well. As part of the aquifer exemption process, Mr. Arthur gathered statistical information pertaining to aquifer exemptions nationally and has met and interfaced with both State and Federal regulatory officials. Mr. Arthur also worked with regulatory officials and client representatives to define the scope of required submittals in the aquifer exemption petition. In addition, Mr. Arthur spearheaded negotiations with upper-level management in the Underground Injection Control Programs from EPA's Region IV and EPA Headquarters offices.

For the City of Enid, Oklahoma, Mr. Arthur has provided "Technical Expert Services" pertaining to the development and negotiation of agreements between the City and oil and gas producing companies operating within the boundaries of the City's sole source water supply wellfield. As part of this project, Mr. Arthur reviewed detailed production reservoir and injection zone information and analyses and developed operating practices, well construction specifications, surface facility specifications, and testing requirements for injection well operations in this sensitive area of northern Oklahoma. Mr. Arthur's role in this project also included witnessing construction and testing operations, testifying to members of the City Council, and consulting with the City Attorney and technical staff. Since the development of the initial agreement for this project, other cities and municipalities in Oklahoma have requested the agreement and used it as a baseline from which to develop similar types of agreements.

For the South Florida Water Management District (SFWMD), Mr. Arthur provided regulatory support and technical guidance for a proposed regional aquifer exemption that would permit reclaimed water injection and recovery into brackish water bearing aquifers in south Florida. Throughout the project, Mr. Arthur also prepared material in support of the exemption, reviewed both state and federal regulatory statutes applicable to aquifer exemptions, endangerment to underground sources of drinking water (USDWs), and how classifications of USDWs vary nationally. Mr. Arthur also researched the legislation that ultimately led to the aquifer exemption variance clause, which is now in the Code of Federal Regulations.

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For the Ground Water Protection Council, Mr. Arthur managed a project involving the preparation of a technical handbook pertaining to mechanical integrity testing methods applicable to Class II injection wells. The handbook was used in a national seminar series presented by the Ground Water Protection Council and will be structured for presentation to both industry and regulatory professionals. Mr. Arthur served as one of the instructors for the seminar series.

Through an indirect contract with the United States Environmental Protection Agency, Mr. Arthur completed the evaluation of external mechanical integrity demonstrations for approximately twenty-five (25) Class I hazardous waste injection wells located in Texas. Evaluations were focused toward the review and interpretation of radioactive tracer surveys and logging methods used for assessing cement bonding (including cement bonds logs, segmented bond tools, ultrasonic imagery tools, cement evaluation tools, pulsed echo tools, etc.). Reviews and interpretations were documented and forwarded to the EPA in Region VI through the Prime Contractor. The project provided Mr. Arthur with an opportunity to evaluate numerous logs performed by a variety of logging companies for a wide variety of well construction types. Levels of documentation and log presentation as well as interpretations were also reviewed/evaluated when available.

Mr. Arthur has managed several injection well projects for the City of St. Petersburg, Florida. These projects have included all facets of the City's injection system program. The City of St. Petersburg's injection system consists of ten Class I municipal injection wells located at four separate injection facilities, with a total combined maximum injection capacity of approximate 60 million gallons per day. These injection wells serve as a backup to the City's reclaimed water irrigation system and utilize an injection zone consisting of a highly fractured dolomite. A semi-confining layer of low permeability carbonates contains the reclaimed water injected in St. Petersburg. As part of an ongoing monitoring program at these facilities, Mr. Arthur has conducted detailed evaluations at each of the St. Petersburg sites to determine the effects of reclaimed water injection on the hydrogeologic systems. Data and information considered in these evaluations include monitoring well hydraulic and geochemical data, injection well flow and pressure data, injection well hydraulic testing data, area and regional geologic and hydrogeologic data, tidal data, reclaimed water (i.e., injectate) data, rainfall data, mechanical integrity results, and numerous applicable publications from such agencies as the United States Geological Survey (USGS), the Southwest Florida Water Management District (SWFWMD), the Environmental Protection Agency (EPA), and others. In addition to support permitting and reclassification efforts, geochemical analysis (including geochemical modeling and sample analysis), environmental risk assessments, well inventories (including field verifications), and regional water use surveys were conducted under Mr. Arthur's supervision.

As a result of the above detailed engineering evaluations for the injection wells in St. Petersburg and as part of a preventive maintenance program, Mr. Arthur also has designed, conducted, and evaluated acid treatment programs (i.e., well stimulations) for the City to restore injection capacities. These stimulations have resulted in injection capacity restorations of over 300 percent. In fact, capacities at some wells have exceeded original "pre-injection" capacities.

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For the City of St. Petersburg, Mr. Arthur assisted in the development and provided resident engineering services for sensitivity testing of a new alternative mechanical integrity testing method in Florida. The new alternative test was used for the first time to demonstrate both internal and external integrity of two (2) 30-inch-diameter municipal injection wells at the City's Northwest Water Reclamation Facility (WRF). The sensitivity testing and demonstrations conducted at these wells resulted in significant savings to the City of St. Petersburg and ultimately, approval of the test by the State. During the sensitivity testing, a leak detection capability of 0.1 gpm was demonstrated. Confirmation of the test's effectiveness and overall usability was confirmed during additional testing conducted at the City's Southwest WRF by the U.S. EPA and in confirmation testing, which compared sensitivities of the test with the results of the standard packer pressure test. The test has now been used on ten (10) Class I municipal injection wells in Florida.

For a confidential industrial client, Mr. Arthur served as task manager and lead Hydrogeologist for the feasibility evaluation (including modeling), design, permitting, construction, and testing (including mechanical integrity) of a Class V aquifer remediation injection well in Citrus County, Florida. The injection well was part of a comprehensive plan designed to remediate an aquifer contaminated with organic compounds within an area having karst features and significant tidal and regional hydrogeologic influences. This project was of particular interest because it involved a city municipal well field that was being potentially threatened by the contamination, and due to the high transmissiveness of the aquifer, extraction rates of up to 500 gpm were proposed. In addition to the injection well portion of the project, Mr. Arthur was responsible for the installation of monitoring wells for delineation of the horizontal and vertical extent of contamination; recovery well design and construction; preparation of technical reports supporting the contamination assessment and injection well permitting efforts; regulatory negotiations; and related hydrogeologic assessments of the site pertaining to both the contamination assessment and injection well feasibility evaluation.

For a confidential Southwest Florida Utility Company, Mr. Arthur served as technical lead and was one of two resident engineers involved with the conversion of a deep exploratory well (3,500 feet) and water supply well (700 feet) to a Class I municipal injection well (3,000 feet) and dual-zone monitoring well (2,300 feet) in Port Charlotte, Florida. Mr. Arthur was responsible for analysis of reverse-air drilling samples; preparation of daily and weekly construction reports; observation of construction and testing activities (including geophysical logging and the mechanical integrity demonstration); geologic sample description; routing of contractor submittals; processing of contractor pay requests; and preparation of the final injection well report and operation and maintenance manual.

For the same utility company, Mr. Arthur managed the feasibility evaluation, design, and permitting of a test injection and monitoring well system at a separate site in western Charlotte County, Florida. Additionally, after a detailed area of review (AOR) evaluation, a number of wells were found to penetrate potential confining units; an exploratory oil test well discovered during the AOR investigation was found to penetrate through the injection zone itself. As a result, a corrective action plan was prepared to plug and abandon these wells in a sound technical manner which would still allow construction and utilization of the injection well system.

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Because of his extensive experience with MI testing methodologies, especially the oxygen activation (OA) log, Mr. Arthur was asked to evaluate technical reports pertaining to the use and testing of the OA log by EPA's Robert S. Kerr Environmental Research Laboratory in Ada, Oklahoma. The reports, prepared by the lab, were a result of extensive testing performed at experimental wells maintained by the EPA. Mr. Arthur also was extensively involved in the development and initial field-testing of the OA log as a method of demonstrating external MI while working for the EPA in Region V and as a member of the EPA's National Mechanical Integrity Test Workgroup. While working in the EPA's Region V office, Mr. Arthur was the prime author of the federal register notice giving interim approval to the OA log.

Mr. Arthur has managed an assortment of projects for a Class I industrial injection system in Pensacola, Florida, for American Cyanamid Company (now Cytec Industries). Some of the tasks Mr. Arthur has performed include planning, performing, and evaluating internal and external MI testing at the facility's two Class I wells; evaluating the effectiveness of the annular monitoring systems for the injection wells; developing plugging and abandonment plans and procedures (including cost estimates); providing technical support for the facility's state water quality exemption and federal aquifer exemption; and reviewing monitoring data from both the injection and monitoring wells. He also provided technical support during regulatory negotiations and Technical Advisory Committee (TAC) meetings.

For the Englewood Water District in Sarasota County, Florida, Mr. Arthur managed and provided resident engineering services for mechanical integrity testing of a Class I injection well. The well is used to dispose of reverse osmosis concentrate and utilizes fiberglass-reinforced plastic as the final and innermost casing. As part of the mechanical integrity demonstration, both internal and external integrity of the well were established with only minimal disruption to ongoing plant activities. Mr. Arthur coordinated work efforts with representatives of the Federal Department of Environmental Regulation (FDER) and prepared the final engineering report, which summarized the test results.

For a confidential client, Mr. Arthur managed and completed a feasibility study for a proposed Class I industrial waste injection well in DeSoto County, Florida. The study included evaluating regional and area hydrogeologic and geophysical data in southwest Florida and DeSoto County, Florida. Waste characterization and preliminary injection and monitoring well design were prepared, as well as sequential construction procedures and a well inventory. The project required coordination and data acquisition from several state and federal agencies.

For a confidential client, Mr. Arthur performed a preliminary feasibility study and conceptual design of a Class I industrial waste injection well to be located in central Illinois. The study and design included reviewing construction and operating data for existing Class I and II wells in the area, Illinois EPA regulations and requirements, and numerous publications pertaining to the geologic framework and operations of injection wells in the region.

Prior to beginning his consulting career, Mr. Arthur worked as an Environmental Engineer for EPA in Region V (Chicago, Illinois). He was responsible for enforcement and compliance activities relating to the Safe Drinking Water Act (SDWA) as amended and applicable 40 Code of Federal

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Regulations for the Underground Injection Council (UIC) Program. Mr. Arthur was involved extensively with the enforcement, permitting, tracking, construction, testing, and plugging of Class I through V injection wells in Region V. He has reviewed numerous hydrogeologic studies to verify the effects of injection on underground sources of drinking water (including aquifer exemption petitions) and was the prime author of the regional guidelines for mechanical integrity testing and plugging and abandonment for the UIC program.

Part of Mr. Arthur's responsibilities as an environmental engineer with Region V included coordinating the field programs in Michigan and Indiana; evaluating all plugging and abandonment plans and providing oversight decision-making during pluggings; reviewing MI demonstrations; reviewing UIC permit applications; and evaluating injection well operation of various well types for compliance with federal UIC regulations. Throughout Mr. Arthur's career with EPA, he witnessed or was involved with more than 500 MITs and 400 well pluggings and plugging and abandonment plans, and personally performed more than 150 site inspections of various types on Class I through V injection wells.

As part of Mr. Arthur's responsibilities as a regional compliance officer for EPA, he was involved in multi-media site inspections to federal facilities with EPA personnel from other programs and with UIC contract field inspectors. He also conducted site inspections at two federal facilities where several types of Class V wells were identified, including storm water disposal wells and others. During the site inspections, these wells were generally evaluated for non-compliance or endangerment to USDWs. In addition, Mr. Arthur inspected storm water drainage as well as other types of Class V wells at industrial facilities in Michigan and Indiana.

While employed with EPA in Region V, Mr. Arthur was a member of the National Mechanical Integrity Test (MIT) Workgroup. As a member of the workgroup, he was responsible for witnessing and evaluating numerous alternative mechanical integrity (MI) testing methods for various types of wells throughout the country. During Mr. Arthur's tenure in the MIT workgroup, he reviewed over twenty (20) proposed alternate MI testing methods and took a lead role in ultimate approval of several tests, including the Oxygen Activation log and the Dual-Completion test.

Mr. Arthur is familiar with several techniques and methods used to identify USDWs and has evaluated aquifer exemption proposals relating to UIC permit applications and injection well permit modifications. He has evaluated engineering studies regarding maximum allowable injection pressures and area-of-review (AOR) investigations for injection well projects in Illinois, Indiana, Michigan, and Ohio. During these studies, the effects of injection were evaluated to determine the maximum injection pressure allowable while not propagating vertical fractures, endangering improperly plugged or constructed wells, or causing contamination to USDWs in the AOR. As part of the permitting evaluation, he reviewed and evaluated several AOR proposals and the potential effects that injection might have on wells within the AOR for a variety of well completion types and under varying geologic and hydrogeologic settings.

Mr. Arthur provided technical assistance to EPA regional coordinators for EPA's hazardous waste "land ban" effort for deep well injection and is familiar with its associated regulations and

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requirements. While a part of Region V's land ban review team, he was responsible for land ban petitions at three hazardous waste injection facilities in Michigan and for reviewing and approving certain section of petitions, including mechanical integrity and other sections of petitions in Michigan, Ohio, Illinois, and Indiana. Mr. Arthur also witnessed numerous injection well hydraulic and integrity testing demonstrations for the petition process.

As the technical liaison between Region V's Enforcement and Program Management Units, Mr. Arthur was involved in primacy state audits and evaluations. His involvement in the Illinois Department of Mines and Minerals resulted in significant changes to the existing State Class II UIC program. Mr. Arthur provided technical support to primacy state agencies on a number of issues and on a variety of well classes. For example, he organized technical review teams, including the National MIT Workgroup and Region V MIT Committee, to evaluate potential mechanical integrity tests for Class II annular disposal wells in Ohio.

Mr. Arthur was involved in several administrative and criminal enforcement cases while working for the EPA in Region V. The most significant criminal case Mr. Arthur was involved in resulted in the first criminal conviction stemming from violations related to the SDWA as amended. For the case, Mr. Arthur prepared technical reports, briefings, and other material for the Office of Criminal Investigation. Mr. Arthur was involved in numerous other informal and formal enforcement cases for a wide variety of violation types and complexities. In addition, Mr. Arthur provided technical support and consultation for both enforcement case negotiations and settlements.

For Cuesta Energy Corporation, Mr. Arthur served as a Field Engineer supporting various projects in Central and Western Oklahoma, primarily the Sooner Trend. While employed with Cuesta, Mr. Arthur supported drilling, completion and production operations and worked directly with the Chief Engineer and Field Forman (primarily). Mr. Arthur was involved in numerous new and existing wells. Further, Mr. Arthur worked with the company's President on developing new prospects, gather data and information from the Log Library in Oklahoma City, and various other tasks.

Professional Organizations:

Society of Petroleum Engineers
 National Association of Forensic Engineers
 Petroleum Historical Institute
 Seismological Society of America
 Dark Sky Institute
 American Society of Civil Engineers
 Society of Professional Well Log Analysts
 American Association of Petroleum Geologists
 Ground Water Protection Council
 International Association of Hydrogeologists
 Southeast Geological Society
 Montana Geological Society
 Society of American Military Engineers

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The Nature Conservancy
Sierra Club
Wildlife Federation
National Ground Water Association
Various Others

Recent Publications and Presentations:

NOTE: Mr. Arthur makes many presentations each year and the list presented below may not be completely up-to-date and may not include all presentations and/or publications completed by Mr. Arthur.

J. Daniel Arthur, Tom Tomastik, and William Green (ALL Consulting). Application of Infrared Imagery for the Identification of Leaking Historical Production and Idle Oil & Gas Wells in Ohio" presented at Petroleum History Institute Oil History Symposium, Findlay, Ohio. July 2017.

J. Daniel Arthur and Kris Andersen (ALL Consulting). The Changing Oilfield: An Environmental Impact Perspective." Presented at the Petroleum History Symposium, Findlay, Ohio. July 2017.

J. Daniel Arthur and Nathan Alleman (ALL Consulting). Induced Seismic Monitoring: A Regulatory Update. Presented at the Independent Petroleum Association of New York. July 2017.

J. Daniel Arthur, P.E., SPEC. "Oilfield Water Injection: A Summary of Issues". Presented at the 2017 Ground Water Protection Council UIC Conference. Austin, TX. February 21-23, 2017.

Tom Tomastik and J. Daniel Arthur, P.E., SPEC (ALL Consulting). "An Evaluation of Well Construction/Drilling/Conversion Methodologies Associated with Gas Storage Depleted Field Operations in the United States." Presented at the Ground Water Protection Council's Annual Forum. Orlando, FL. September 11-14, 2016.

Steve Tipton, J. Daniel Arthur, P.E., SPEC, and Nate Alleman (ALL Consulting). "Innovation in the Oilfield: How Best Management Practices Have Reduced the Impacts of Shale Development." Presented at the 23rd IPEC Conference. New Orleans, LA. November 8-10, 2016.

J. Daniel Arthur, Tom Tomastik, David Cornue, and Mark Russell (ALL Consulting). Understanding Key Aspects of Well Integrity: A Workshop Ground Water Protection Council, Annual Forum, Orlando, Florida, September 11-14, 2016.

Nate Alleman; J. Daniel Arthur, P.E., SPEC; David Alleman; Tom Tomastik; and Kris Andersen (ALL Consulting). "Underground Natural Gas Storage in the U.S.: State of Play". Presented at the 2016 GWPC Annual Forum. Orlando, FL. September, 2016.

J. Daniel Arthur, P.E. (ALL Consulting) and Will Green, P.G. (ALL Consulting), "Well Integrity Analysis using Infrared Imaging." Presented at the GWPC Annual Forum: State Water Sustainability Planning. Orlando, Florida, September 2016.

Arthur, J.D. "Application of Well Integrity Methods for Gas Storage Wells". Presented at the U.S. DOE National Laboratories Workshop on Well Integrity for Natural Gas Storage in Depleted Reservoirs and Aquifers, Denver, Colorado, July 12-13, 2016.

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J. Daniel Arthur, P.E., SPEC; Kris Andersen; Tom Tomastik; and Nathan Alleman (ALL Consulting). "A Historical Look at Underground Natural Gas Storage in America". Presented at the Petroleum History Symposium, Casper, WY. July 28-31, 2016.

David Alleman; J. Daniel Arthur, P.E., SPEC; Nathan Alleman; Tom Tomastik; and Kris Andersen (ALL Consulting). "A Look at Underground Natural Gas Storage Operation and Regulation in the United States". Presented at the 2016 IOGCC Annual business Meeting. Denver, CO. May, 2016.

J. Daniel Arthur, Will Green P.G., Tom Tomastik and Kris Andersen, ALL Consulting, "A Proactive Approach to Addressing Annular Pressure Issues in the Utica-Point Pleasant Shale Play" Presented at the AADE Annular Gas Migration Conference, Ohio, April 28, 2016.

Arthur, J. Daniel, Tom Tomastik, David Overstreet, and Greg Casey, ALL Consulting. "Class II Disposal Well Best Management Practices Workshop." Presented at the GWPC 2016 UIC Annual Conference, Denver, Colorado, February 23-25, 2016.

Nathan Alleman; J. Daniel Arthur, P.E., SPEC; Tom Tomastik; and Kris Andersen (ALL Consulting). "A Look at Underground Natural Gas Storage Operation and Regulation in the United States". Presented at the GWPC 2016 UIC Conference. Denver, CO. February 25, 2016.

J. Daniel Arthur, Tom Tomastik, Kris Anderson, and Will Green, ALL Consulting, "A Proactive Approach to Addressing Annular Pressure Issues and Stray Gas Migration in the Unconventional Shale Plays" Presented at the GWPC 2016 UIC Annual Conference, Denver, Colorado, February 23-25, 2016.

J. Daniel Arthur (ALL Consulting). "Gas Well Integrity and Associated Gas Migration Investigations in the Marcellus Shale." Presented at the National Association of Forensic Engineers, Winter Meeting 2016, Tampa, FL, January 23, 2016.

Nate Alleman, J. Daniel Arthur, P.E., SPEC, and Mark Faucher (ALL Consulting). "Innovation in the Oilfield: How Best Management Practices Have Reduced the Impacts of Shale Development." Presented at the SPE Mid-Continent Section Luncheon. Denver, CO. January 13, 2016.

Mark Faucher, J. Daniel Arthur, P.E., SPEC, and Nathan Alleman (ALL Consulting). "Innovation in the Oilfield: How Best Management Practices Have Reduced the Impacts of Shale Development." Presented at the Environmental Technology & Management Association (ETMA) Technical Dinner Meeting. Saudi Arabia. December 15, 2015.

Nathan Alleman, J. Daniel Arthur, P.E., SPEC, and Mark Faucher (ALL Consulting). "Innovation in the Oilfield: How Best Management Practices Have Reduced the Impacts of Shale Development." Presented at the 22nd IPEC Conference. Denver, CO. November 17-19, 2015.

Tipton, D. Steven, PE (ALL Consulting). "The Oklahoma Water Conundrum." Presented at the Ground Water Protection Council Annual Forum, September 28-30, 2015, Oklahoma City, OK.

J. Daniel Arthur, P.E., SPEC., Kris Andersen. "Spill Response in Ohio: Practical Guidance for Operators of Horizontal Oil and Gas Wells". Presented at GWPC Conference in Oklahoma City, OK. September 2015.

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J. Daniel Arthur, P.E., SPEC, Thomas E. Tomastik, Greg Casey, P.E., H. William Hochheiser, David Alleman, Fernando DeLeon, Chuck Lowe (ALL Consulting). "How Things Have Changed: Class II Disposal Wells and Unconventional Oil and Natural Gas Development." Presented at GWPC Conference in Oklahoma City, OK. September 2015.

Arthur, J. Daniel (ALL Consulting). "The Necessary Transition of Best Practices for Conventional Resource Development to Modern Shale Development Worldwide." Presented at Global Shale Oil & Gas Summit – 2015 Europe. London, UK. July 9-10, 2015.

David Overstreet, J. Daniel Arthur, P.E., SPEC, and Nate Alleman (ALL Consulting). "Innovation in the Oilfield: Reducing Environmental Impacts of Shale Development through Best Management Practices." Presented at the Independent Oil and Gas Association of New York. Findley Lake, NY. July 7-9, 2015.

Arthur, J. Daniel (ALL Consulting). "It's Not Easy Being Green: Why Does the Color of the Chemicals Matter?" Presented at the 2015 National Science Foundation Workshop at the University of Arkansas at Little Rock, Little Rock, Arkansas, April 2015.

J. Daniel Arthur, P.E., SPEC and Kris Andersen (ALL Consulting). "Spill Response in Ohio: Practical Guidance for Operators of Horizontal Oil & Gas Wells." Presented at the American Independent Association of Professional Geologists, Columbus, Ohio, April 2015.

J. Daniel Arthur, P.E., SPEC; Kevin Shepard, P.E.; and Blake Arthur, P.E. (ALL Consulting). "Ohio Horizontal Well Sites: Past History and Future Regulations." Presented at the American Independent Association of Professional Geologists, Columbus, Ohio. April 2015.

Tomastik, Tom and Arthur, J. Daniel (ALL Consulting). "Class II Saltwater Disposal Wells in Ohio: Understanding the Avenue to Success." Presented at the American Independent Association of Professional Geologists, Columbus, Ohio. April 2015.

Tomastik, T. and J. Daniel Arthur, ALL Consulting, "A Proactive Approach to Induced Seismicity: Can the Oil and Gas Industry Manage Induced Seismicity and Work in Cooperation with the Regulatory Agencies?" Presented at the GWPC 2015 UIC Conference, Austin, Texas, February 9-11, 2015.

Tomastik, Tom and Arthur, J. Daniel (ALL Consulting). "A Proactive Approach to Induced Seismicity: Can the Oil & Gas Industry Manage Induced Seismicity and Work in Cooperation with the Regulatory Agencies?" Presented at the Ohio Oil & Gas Association Oilfield EXPO and Technical Conference, December 2014.

J. Daniel Arthur, P.E., SPEC., Bill Hochheiser, "Water Use Analysis for Shale Development in the United States". Presented at the 21st Annual IPEC Conference, Houston, TX. October 14-16, 2014.

J. Daniel Arthur, Tom Tomastik, Doug Louis, and Fernando DeLeon, ALL Consulting. "Disposal Wells and Shale Resource Development: A National Perspective." Presented at the GWPC Annual Meeting, Seattle, WA, October, 5-8, 2014.

J. Daniel Arthur, P.E.

Arthur, J.D., Casey, Greg, Bruce Jankura, and Tom Tomastik (ALL Consulting). "Summary of Recent Advances in Well Integrity Analysis for Wellbore Gas Intrusion". Presented at the Ground Water Protection Council's Annual Meeting, Seattle, Washington. October 5-8, 2014.

Arthur, J.D. (ALL Consulting), Casey, G. (ALL Consulting), and Zampogna, D. (ALL Consulting). "Engineering Best Practices for Well-Site Environmental Protection". Presented at the American Society of Civil Engineers' Shale Energy Engineering Conference, Pittsburgh, PA. July 20-23, 2014.

J. Daniel Arthur, P.E., SPEC., Bill Hochheiser, Roy Arthur "Analysis of U.S. Hydraulic Fracturing Chemical Disclosure Data from FracFocus." Presented at Hydraulic Fracturing in Western Canada – an Environmental Perspective. May 29, 2014.

Arthur, J.D. (ALL Consulting), Hagemeyer, P. (ALL Consulting), and Overstreet, D. (K&L Gates). "Oil & Gas Development and Environmental Protection". Presented at the Ground Water Protection Council's Annual UIC Conference, New Orleans, Louisiana. January 22, 2014.

Arthur, J. Daniel and David Alleman (ALL Consulting). "Innovative Strategies for Management of Water in Unconventional Resource Projects." Presented at the 33rd Annual Governor's Water Conference, 10th Annual OWRRI Water Research Symposium, Tulsa, Oklahoma, November 13-14, 2013.

Arthur, J.D., (ALL Consulting). "Proactive Well Planning and Well Integrity Testing Practices for Groundwater Protection in Shale Plays." Presented at the SPE Water Lifecycle Workshop, Galveston, TX. October 22-23, 2013.

Arthur, J.D., Damian Zampogna, Brian Bohm (ALL Consulting), Steve Lakeman (INFICON). "Developing Analytical Tools and Practices for Groundwater Quality and Production Well Integrity Investigations in Situations of Alleged Stray Gas Migration." Presented at the Ground Water Protection Council's Annual Forum, Saint Louis, Missouri. September 22-25, 2013.

Arthur, J.D. (ALL Consulting) and Casey, Greg (ALL Consulting). "Summary of Recent Advances in Well Integrity Analysis for Wellbore Gas Intrusion". Presented at the Ground Water Protection Council's GWREF Joint Spotlight Series, Grapevine, Texas, July 9-11, 2013.

Alleman, David, D. Arthur, P.E., SPEC, J. Cline, W. Hochheiser, ALL Consulting. "Navigating Water issues in Texas: Water Sourcing, Produced Water Management, Spills, and Construction Issues". Presented at the Ground Water Research and Education Foundation's 2013 Unconventional Oil & Gas Water Management Forum, July 9-11, 2013, Grapevine, TX.

Arthur, J. Daniel; Casey, B. Greg; Cline, Jeff T.; Hochheiser, H. William (ALL Consulting). "Modern Management of Exploration and Production Waste" (Paper #12968). Presented at the 106th Annual Conference & Exhibition, Air & Waste Management Association, June 25 – 28, 2013, Chicago, Illinois.

Arthur, J.D., and D. Alleman (ALL Consulting). "The Application of Produced Water Treatment and Water Blending in Shale Resource Development" Presented at the New York Water Environment Association 2013 Spring Technical Conference and Exhibition, Syracuse, New York, June 3-6, 2013.

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Zampogna, D.M. (ALL Consulting); Cornue, D., (ALL Consulting); Bohm, B. (ALL Consulting); Arthur, J.D., (ALL Consulting). "Summary of Water Quality Impacts from Historical Oil and Gas Well and Industrial Development in Northeast Pennsylvania Counties". Presented at the Petroleum History Institute, Pittsburgh, Pennsylvania, May 18, 2013

Arthur, J. Daniel (ALL Consulting). "No Water – No Fracturing – No Resource Plays: Digging Deeper into the Story." Society of Petroleum Engineers, Oklahoma City, Oklahoma, March 23, 2013.

Arthur, J. Daniel (ALL Consulting). "Lifecycle Water Management Considerations in Unconventional Resource Plays." Society of Petroleum Engineers, Advanced Technology Workshop on Water Treatment for Unconventional Production, Ft. Worth, Texas, March 4-6, 2013.

Arthur, J. Daniel and Damian Zampogna (ALL Consulting). "Water Sourcing Strategies for Shales." American Association of Petroleum Geologists (AAPG) Geosciences Technology Workshop, Solving Water Problems in Oil and gas Production: New Technologies for Cost Savings and New Revenue Flows, Ft. Worth, Texas, February 26-27, 2013.

J. Daniel Arthur, P.E., SPEC. "The Critical Link between Aquifer Exemptions and the Sustainability of Water Resources as Part of Unconventional Resource Development". Presented at the Ground Water Protection Council's 2013 UIC Conference, Sarasota, Florida. January 22-24, 2013.

Arthur, J. Daniel, and Dave Bockelmann (ALL Consulting). "Cumulative Impacts of Water Use for Shale Plays: A National Scope." Shale EnviroSafe Conference & Exhibition, New Orleans, Louisiana, November 14-15, 2012.

Arthur, J. Daniel (ALL Consulting). "The Modern Practices of Hydraulic Fracturing: A Focus on Canadian Resources." Canadian Association of Petroleum Producers, Calgary, Alberta (Canada), November 14, 2012.

Arthur, J. Daniel (ALL Consulting). "The Environmental Implications of Hydraulic Fracturing in the Marcellus Shale." Presented at Dividing the Waters Fracturing and Water Workshop, Pittsburgh, Pennsylvania, November 8-9, 2013.

Arthur, J. Daniel, and David Alleman (ALL Consulting). "Alternate Water Sourcing and Management for Shale Gas." The 19th International Petroleum Environmental Conference, Denver, Colorado, October 30-November 1, 2012.

Arthur, J. Daniel (ALL Consulting). "The Modern Practices of Hydraulic Fracturing: A Focus on Canadian Resources." Interstate Oil & Gas Compact Commission, San Antonio, Texas, October 28-31, 2012.

Arthur, J. Daniel, Mark Layne, Preston Wilson (ALL Consulting). "Evolution and Economics of Managing Water in Unconventional Resource Plays." Presented at the Oklahoma Water Survey Workshop on Oil & Gas Operations and Protecting Water Resources, Norman, Oklahoma, October 25, 2013.

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Arthur, J. Daniel, and Dave Cornue (ALL Consulting). "The Modern Practices of Hydraulic Fracturing for Canadian Resources." Independent Oil & Gas Association of New York, Niagara Falls, NY, October 24, 2012.

Arthur, J. Daniel (ALL Consulting). "Innovative Strategies for Managing Water in Unconventional Resource Plays." ALL Consulting Fall Technology Training Workshop, Tulsa, Oklahoma, October 12, 2012.

Arthur, J. Daniel (ALL Consulting). "Analysis of FracFocus Data and an Industry Dealing with Change." ALL Consulting Fall Technology Training Workshop, Tulsa, Oklahoma, October 12, 2012.

Arthur, J. Daniel (ALL Consulting). "The Shale Revolution." ALL Consulting Fall Technology Training Workshop, Tulsa, Oklahoma, October 12, 2012.

Arthur, J. Daniel (ALL Consulting). "Well Integrity and Unconventional Resource Development." ALL Consulting Fall Technology Training Workshop, Tulsa, Oklahoma, October 12, 2012.

Arthur, J. Daniel and Roy Arthur, Roy (ALL Consulting). "The Risk Based Data Management System." ALL Consulting Fall Technology Training Workshop, Tulsa, Oklahoma, October 12, 2012.

Arthur, J. Daniel (ALL Consulting). "Environmental Lessons Learned and Application of Best Management Practices to Both New and Existing Shale Plays." Ground Water Protection Council's Annual Forum, Nashville, Tennessee, September 23-26, 2012.

Arthur, J. Daniel (ALL Consulting). "Water Management Issues Critical to Development of the Eagle Ford Shale." Society of Petroleum Engineers Eagle Ford Advanced Technology Workshop, San Antonio, Texas, August 22-23, 2012.

Arthur, J. Daniel (ALL Consulting). "Myth-Busting Case Studies: How Did We Get Into This Mess?" American Association of Petroleum Geologists Geosciences Technology Workshop, Hydraulic Fracturing: New Controversies and Key Plays, Golden, Colorado, August 13-15, 2012.

Arthur, J. Daniel (ALL Consulting). "Wellbore Integrity Related to Stray Gas Intrusion." American Association of Petroleum Geologists Geosciences Technology Workshop, Hydraulic Fracturing: New Controversies and Key Plays, Golden, Colorado, August 13-15, 2012.

Arthur, J. Daniel (ALL Consulting). "Understanding and Assessing Well Integrity Relative to Wellbore Stray Gas Intrusion Issues." Ground Water Protection Council Stray Gas Forum, Cleveland, Ohio, July 24-26, 2012.

Arthur, J. Daniel (ALL Consulting). "Environmental Costs of Energy and the Basics on Shale Development in America." IEEE Green Technologies Conference, Tulsa, Oklahoma, April 19-20, 2012.

Arthur, J. Daniel, Brian Bohm, and Bobbi Coughlin (ALL Consulting). "The Latest on Environmental and Regulatory Constraints Impacting Shale Oil & Gas Development." Society of Petroleum Engineers Dallas Section Meeting, Dallas, Texas, January 18, 2012.

J. Daniel Arthur, P.E.

Arthur, J. Daniel (ALL Consulting). "Internal and External Mechanical Integrity as Part of Unconventional Gas Development." Ground Water Protection Council's Annual Forum, Atlanta, Georgia, September 25-28, 2011.

Arthur, J. Daniel (ALL Consulting). "Water Management Planning for Unconventional Resource Development." Ground Water Protection Council's Annual Forum, Atlanta, Georgia, September 25-28, 2011.

Arthur, J. Daniel (ALL Consulting). "Water Management Planning in the Eagle Ford Shale Play." Society of Petroleum Engineers Eagle Ford Advanced Technology Workshop, Austin, Texas, August 24-26, 2011.

Arthur, J. Daniel, and David Alleman (ALL Consulting). "Regulatory Impact/Community Outreach: Regulatory Viewpoint." Society of Petroleum Engineers Advanced Technology Workshop on Reducing Environmental Footprint in Shale Development, Pittsburgh, Pennsylvania, April 27-28, 2011.

Arthur, J. Daniel, and David Alleman (ALL Consulting). "An Approach to Well Integrity Assessment: Best Management Practices in the Marcellus Shale Region." Society of Petroleum Engineers Workshop on Reducing Environmental Impact of Unconventional Resource Development, San Antonio, Texas, April 23-25, 2011.

Arthur, J. Daniel, Mark Layne, and Roy Arthur (ALL Consulting); Mike Paque (GWPC); and Gerry Baker (IOGCC). "Overview and Utilization of the National Hydraulic Fracturing Disclosure Registry." American Institute of Professional Geologists Marcellus Shale Conference, Pittsburgh, Pennsylvania, April 13-14, 2011.

Arthur, J. Daniel, and Bobbi Coughlin (ALL Consulting). "Cumulative Impacts of Shale Gas Water Management: Considerations and Challenges (SPE 142234)." Society of Petroleum Engineers, SPE Americas E&P Health, Safety, and Environmental Conference, Houston, Texas, March 21-23, 2011.

Arthur, J. Daniel, H.W. Hochheiser, and B.J. Coughlin (ALL Consulting). "State and Federal Regulation of Hydraulic Fracturing: A Comparative Analysis." Society of Petroleum Engineers Hydraulic Fracturing Conference, The Woodlands, Texas, January 24-26, 2011.

Arthur, J. Daniel (ALL Consulting). "Summary of Environmental Issues, Mitigation Strategies, and Regulatory Challenges Associated with Shale Gas Development in the United States and Applicability to Development and Operations in Canada." Canadian Unconventional Resources and International Petroleum Conference (CURIPC), Calgary, Alberta, Canada, October 20, 2010.

Arthur, J. Daniel (ALL Consulting). "Water and Shale Gas Development." National Association of Royalty Owners (NARO), Water for Shale Gas Development, National Convention, Pittsburgh, Pennsylvania, October 7, 2010.

Arthur, J.D. (ALL Consulting). "A Comparative Analysis of Hydraulic Fracturing and Underground Injection." GWPC Water/Energy Symposium, Pittsburgh, Pennsylvania, September 25-29, 2010.

J. Daniel Arthur, P.E.

Arthur, J.D., J. Roberts, N. Alleman, and D. Alleman (ALL Consulting). "Use of Oil and Gas Produced Water for Power Plant Cooling." GWPC Water/Energy Symposium, Pittsburgh, Pennsylvania, September 25-29, 2010.

American Energy and Environmental Research Foundation (AEERF). "The Environmental Cost of Energy." GWPC Annual Forum and Water/ Energy Symposium, Pittsburgh, Pennsylvania, September 25-29, 2010.

Arthur, J.D. (ALL Consulting). "Water Issues in the Marcellus Shale." Society of Petroleum Engineers (SPE), Denver, Colorado, April 2010.

Arthur, J.D. (ALL Consulting). "Modern Shale Gas Development." Oklahoma Independent Oil & Gas Association, Mid-Continent CBM and Shale Gas Symposium, Tulsa, Oklahoma, December 8, 2009.

Ground Water Protection Council and ALL Consulting. *Modern Shale Gas Development: A Primer*. Prepared for U.S. Department of Energy, Office of Fossil Energy and National Energy Technology Laboratory. DE-FG26-04NT15455. April 2009. (Mr. Arthur served as Project Manager.)

Arthur, J.D. "Environmental and Water Management Challenges Associated with Development of Unconventional Shale Gas Resources." Society of Petroleum Engineers Annual Environmental Conference, San Antonio, Texas, March 2009.

Arthur, J.D., B. Langhus, and D. Alleman. "An Overview of Modern Shale Gas Development in the United States." Society of Petroleum Engineers Annual Environmental Conference, San Antonio, Texas, March 2009.

Arthur, J.D., D. Alleman, and B. Hochheiser. "Update and Summary on the: Modern Shale Gas Development in the United States: A Primer." Presented to the U.S. Department of Energy's Office of Fossil Energy, Washington, D.C., March 2009.

Arthur, J.D. "Environmental Considerations Related to Hydraulic Fracturing of Horizontal Gas Wells of the Marcellus Shale." Ground Water Protection Council Annual UIC Conference, San Antonio, Texas, January 2009.

Arthur, J.D. "Prudent and Sustainable Water Management and Disposal Alternatives Applicable to Shale Gas Development." Produced Water Society 2009 Annual Conference, Houston, Texas, January 2009. Also presented at the Ground Water Protection Council Annual UIC Conference, San Antonio, Texas, January 2009.

Arthur, J.D. (ALL Consulting), E. Gray (Chesapeake Energy), and D. Bockelmann (ALL Consulting). "Natural Gas Development & Production from the Marcellus Shale." Presented to the Nature Conservancy, Eastern Groups, December 2008.

Arthur, J.D., B. Bohm, B. Coughlin, and M. Layne. "Evaluating the Environmental Implications of Hydraulic Fracturing in Shale Gas Reservoirs." 2008 International Petroleum & Biofuels Environmental Conference, Albuquerque, New Mexico, November 2008.

J. Daniel Arthur, P.E.

Arthur, J.D., B. Bohm, B. Coughlin, and M. Layne. "Hydraulic Fracturing Considerations for Natural Gas Development of the Fayetteville Shale." Arkansas Environmental Federation 2008 Annual Meeting, Hot Springs, Arkansas, November 2008.

Bohm, B., J.D. Arthur, and B. Langhus. "Observed Impacts to Groundwater Resulting from the Operation of CBNG Impoundments." 2008 International Petroleum & Biofuels Environmental Conference, Albuquerque, New Mexico, November 2008.

Arthur, J.D., B. Bohm, and M. Layne. "Hydraulic Fracturing Considerations for Natural Gas Wells of the Marcellus Shale." Ground Water Protection Council 2008 Annual Forum, Cincinnati, Ohio, September 2008.

Arthur, J.D. "Hydraulic Fracturing of Marcellus Wells Poses Little Danger to Water." Article published in the *Practical Operator*, a publication of the Pennsylvania Oil & Gas Association, July-September 2008.

Arthur, J.D., and N. Alleman. "Produced Water and Global Climate Change." Ground Water Protection Council 2008 Annual Forum, Cincinnati, Ohio, September 2008.

Arthur, J.D. "Treatment and Management Technologies Applicable to Produced Water in Mature Fields." Scheduled for Presentation at the Society of Petroleum Engineers' Produced Water Handling and Disposal Workshop, Port of Spain, Trinidad and Tobago, June 2008.

Arthur, J.D., and B.G. Langhus. "Current and Evolving Issues Pertaining to Produced Water and the Ongoing Development of Coal Bed Methane." Scheduled for presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

Langhus, B.G., and J.D. Arthur. "Green House Gas Emission Transactions and CBM/CMM." Scheduled for Presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

Langhus, B.G., J. Crissup, J.D. Arthur, and B. Bohm. "Siting, Design, Construction and Reclamation of Coal Bed Natural Gas Impoundments." Scheduled for presentation at the 2008 International Coal Bed & Shale Gas Symposium, Tuscaloosa, Alabama, May 2008.

Arthur, J.D. "Current and Future Potential Alternatives for the Beneficial Use of Produced Water from Onshore Oil & Natural Gas Development." U.S. Environmental Protection Agency's Beneficial Use of Industrial Materials Summit, Denver, Colorado, April 2008.

Arthur, J.D. "Environmental Considerations of Hydraulic Fracturing and Underground Injection of Produced Water Associated with Development of the Marcellus Shale." Society of Petroleum Engineers Produced Water Workshop, Cooperstown, Pennsylvania, March 2008.

Arthur, J.D., B.G. Langhus, L. Moody, M. Korphage, and J. Crissup. "Applying a Synergistic Approach to Sustainable Energy Development." Ground Water Protection Council Meeting, New Orleans, Louisiana, January 2008.

J. Daniel Arthur, P.E.

Arthur, J.D. "Impacts of More Stringent Water Discharge Rules in the Powder River Basin." Presented at the Wyoming Environmental Quality Council Meeting, Cheyenne, Wyoming, January 2007.

Arthur, J.D. "Practical Management of Produced Water from Onshore Oil & Gas Operations." Presented at the Interstate Oil & Gas Compact Commission Meeting, 2007.

Arthur, J.D., D. Winter, and B. Bohm. "Federal Land Access and NEPA: The Need for Oil & Gas Specific NEPA Technical Information." Presented at the Interstate Oil & Gas Compact Commission Meeting, Austin, Texas, October 2006.

Cornue, D., and J.D. Arthur. "Reducing Onshore Natural Gas and Oil Exploration and Production Impacts Using a Broad-Based Stakeholder Approach." Presented at the Interstate Oil & Gas Compact Commission Meeting, Austin, Texas, October 2006.

Arthur, J.D., and B.G. Langhus. "Engineering Environmental Excellence in the Rocky Mountain West: A Case Study of the Cedar Creek Anticline." Presented at the Interstate Oil & Gas Compact Commission Meeting, Billings, Montana, May 2006. Also presented at other venues (2006-2007).

Arthur, J.D., M. Carl, B.G. Langhus, J. Crissup, and B. Bohm. "Management of Produced Water from Onshore Oil & Gas Operations Using a Watershed Analysis Tool." Presented at the Interstate Oil & Gas Compact Commission Meeting and the Ground Water Protection Council Meeting, 2006.

Arthur, J.D., and T.P. Richmond. "Coal Bed Natural Gas Development in the Powder River Basin: Local Objections vs. National Impacts." Presented at the International Petroleum Environmental Conference, Houston, Texas, November 2005.

Arthur, J.D. "Coal Bed Natural Gas Produced Water Management in a Changing and Uncertain Environment." Presented at the Natural Gas Technology Conference, Orlando, Florida, February 2005.

Arthur, J.D. "Overview of Heavy Oil in Michigan." Presented at the Ground Water Protection Council, January 2005.

Arthur, J.D. "Sputnik Resources Michigan Heavy Oil Project." Presented to the Michigan Department of Environmental Quality, Lansing, Michigan, October 2004.

Arthur, J.D. "Coal Bed Natural Gas U.S. Production and Environmental Considerations." Presented to DOE and China Delegation (Annex III – Oil and Gas Coordination Meeting and Coal Bed Natural Gas Workshop), Washington, D.C., 2004.

Arthur, J.D., B. Langhus, and M. Layne. "Feasibility of Re-Injection of Coal Bed Natural Gas Produced Water in the Powder River Basin." Prepared for the Montana Board of Oil & Gas Conservation, 2004.

Arthur, J.D., and T.P. Richmond. "Overview of Coal Bed Methane Best Management Practices and Mitigation Techniques Using Geospatial Techniques." Presented at the API Water Forum, April 2004.

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Arthur, J.D., and T.P. Richmond. "Power River Basin (MT & WY) Coal Bed Methane Infiltration Study Project Workplan." Presented to the Montana Board of Oil and Gas Conservation, Billings, Montana 2004. (Also presented at other venues, including GWPC, IOGCC, at DOE Tulsa Office).

Arthur, J.D. "Using a Nationwide Integrated and Internet-Based GIS by the USDA Forest Service." Presented at the USDA Forest Service Geofest, Park City, Utah, September 2003.

Arthur, J.D. "Development of a Primer on the Background and Development of Coal Bed Methane." Presented at the DOE Coal Mine Methane Project Review/Planning Meeting, Morgantown, West Virginia, April 2003.

Arthur, J.D. "Handbook for Planning and Evaluating Development and Environmental Plans Pertinent to Coal Bed Methane Production." Presented at the DOE Coal Mine Methane Project Review/Planning Meeting, Morgantown, West Virginia, April 2003.

Arthur, J.D. "MT/WY CBM EIS Update." Presented at the Society of Petroleum Engineers Environmental Conference, San Antonio, Texas, March 2003.

Arthur, J.D. "DOE-FE HQ Project Briefing." Presented to DOE-FE, Washington, D.C., March 2003.

Arthur, J.D., and J. Halvorson. "Montana Internet Data Access System." Presented at the Independent Petroleum Association of Mountain States 2003 Energy Technical Conference, Denver, Colorado, January 2003.

Arthur, J.D. "Analysis of the Powder River Basin's Tongue River and the Imminent Development of Coal Bed Methane." Presented at the Ground Water Protection Council, New Orleans, Louisiana, 2003.

Arthur, J.D. "Coal Bed Methane Produced Water Management and Beneficial Use Alternatives." Presented at the SPE Environmental Conference, 2003. (also presented at the Strategic Research Institute Workshop, February 2003).

Arthur, J.D. "Feasibility Study of the Beneficial Use of Coal Bed Methane Produced Water." Presented at the Bureau of Land Management's Fluid Mineral Conference, October 2002.

Arthur, J.D., and J. Seekins. "Preparation of Water Management Plans for the Development of Coal Bed Methane in the Powder River Basin." Presented at the Ground Water Protection Council Conference on Produced Water, October 2002.

Arthur, J.D., and T.P. Richmond. "Using Geospatial Techniques to Develop BMPs and BU Options for Coal Bed Methane." Presented at IPEC, October 2002.

Arthur, J.D., and M. Janowiak. "Updated Information on Analysis of Water Management Alternatives and Beneficial Uses of Coal Bed Methane Produced Water." Presented at the 2002 BLM Fluid Minerals Conference and Annual GWPC meeting, 2002.

Arthur, J.D., and B.G. Langhus. "Coal Bed Methane Best Management Practices." Presented at several workshops and conferences (2002-2004).

J. Daniel Arthur, P.E.

Arthur, J.D., B.G. Langhus, T. Richmond, J.W. Halvorson, and B. Bohm. "Coal Bed Methane Best Management Practices." Presented at the International Petroleum Environmental Conference, Houston, Texas, November 2001.

Arthur, J.D., B.G. Langhus, T. Richmond, and J.W. Halvorson. "Status of the Montana Statewide Environmental Impact Statement and Amendment to the Billings and Powder River RMP." Presented at the Montana Petroleum Association Annual Meeting, Billings, Montana, 2001.

Arthur, J.D., B.G. Langhus, T. Richmond, J.W. Halvorson, and B. Bohm. "Coal Bed Methane Development in the Powder River Basin." Presented at the Ground Water Protection Council Semi-Annual Meeting, Reno, Nevada, 2001.

Arthur, J.D. "Environmental Due Diligence, Scope of Review, Oilfield Considerations." Presented at Louisiana State University/Texas Mineral Law Workshop, November 2000.

Arthur, J.D. "An Introduction and Update of the Risk Based Data Management System." Presented at the TNRCC Annual Environmental Conference, Austin, Texas, 2000.

Arthur, J.D. "RBDMS Project Update." Presented at the DOE Contractors Conference, 2000.

Arthur, J.D., and B.D. Freeman. "Aquifer Exemptions: Wise Use of Environmental Protection Resources." Technical Reviewers included Bill Bryson (Kansas Corporation Commission), Jerry Mullican (Texas Railroad Commission), Paul Roberts (Nebraska Oil & Gas Conservation Commission), Don Warner (University of Missouri-Rolla), Lori Litzen (Shell Western E&P, Inc.), Roger Noble (CH2M HILL, Inc.). Accepted for presentation at the Society of Petroleum Engineers/United States Environmental Protection Agency Environmental Conference, Houston, Texas, March 1995.

Arthur, J.D. "Mechanical Integrity Testing of Injection Well Tubulars." Special topics article for the *American Oil & Gas Reporter*, September 1994.

Arthur, J.D., and M.D. Micheau. "Utilization of Modified Temperature Logging Methods for External Mechanical Integrity Testing on Class III Salt Solution Mining Wells." Presented at the Spring Meeting of the Solution Mining Research Institute in Syracuse, New York, April 25-27, 1993.

Arthur, J.D. "Implementation of Formal Environmental Risk Management Practices into a Class II UIC Program." Presented at the Underground Injection Practices Research Foundation/U.S. DOE Symposium on Class II Injection Well Management and Practices, Houston, Texas, November 1992.

Arthur, J.D. "Aquifer Exemptions for Injection Wells: An Overview." Presented at the Underground Injection Practices Research Foundation/U.S. DOE Symposium on Class II Injection Well Management and Practices, Houston, Texas, November 1992.

Arthur, J.D. "The Underground Injection Practices Research Foundation's Risk Based Data Management System Project - An Overview." Presented at the Ground Water Protection Council's Winter Meeting, Corpus Christi, Texas, January 1992.

J. Daniel Arthur, P.E.

Arthur, J.D. (CH2M HILL), J. Thornhill (US EPA), and T.M. Williams (Atlas). "Oxygen Activation Logging as a Method of Demonstrating External Mechanical Integrity of Injection Wells." Presented at the Underground Injection Practices Council Summer Meeting, Reno, Nevada, July 1991.

Arthur, J.D., J. Thornhill, and T.M. Williams. "Oxygen Activation Logging as a Method of Demonstrating External Mechanical Integrity on Injection Wells." *Proceedings of the Underground Injection Practices Council 1991 Winter and Summer Meetings* (1991): 141-48.

Arthur, J.D., R.J. Deuerling, and P.L. Waller. "Mechanical Integrity Demonstration and Sensitivity Testing of the Radioactive Tracer Survey on Class I Large Diameter Municipal Injection Wells in Florida." Presented at the Underground Injection Practices Council Winter Meeting, Tampa, Florida, January 1990.

With T.D. Bray. "Assessment of Background Water Quality at a Canyon Landfill Site." Presented at the Water Pollution Control Federation Specialty Conference for Water Quality Management of Landfills, Chicago, Illinois, July 16, 1990.

With L. Perenchio, E. Watters, and others. "Regional Guidelines for Conducting Mechanical Integrity Testing in Region V." Prepared for internal regional guidance regarding acceptable methods for performing internal and external MI testing in the direct implementation states of Indiana and Michigan.

With J. DeLashmit, L. Perenchio, E. Watters, and others. "Regional Guidelines for the Plugging and Abandonment of Class I and II Wells in Region V." Prepared for internal regional guidance regarding acceptable methods for properly plugging and abandoning wells within the direct implementation states of Indiana and Michigan.

Short Courses Completed:

Environmental Protection for Oil & Gas Development Activities
Engineering Ethics
Various State Courses required for Engineering Licensure
Well Pad Design (ALL Consulting)
Well Integrity and Gas Migration Investigations (GWPC/ALL)
ALL Consulting Annual Technical Training Seminar (2014, 2013, 2012, 2011, 2010)
Safe Lands
H2S Safety (various courses)
Temperature, Noise, and Radioactive Tracer Logging, Exxon/Robert S. Kerr Lab
Successful Project Management, CH2M HILL
Successful Project Execution, CH2M HILL
Fundamentals of Cementing, Halliburton Services
Petroleum Engineering as related to Underground Injection Control, Richland College, TX
Ground Water Monitoring, Engineering Enterprises
Well Casings and Tubulars, NL Industries
Expert Witness Short Course, NWWA

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Reservoir Pressure Transient Testing, Society of Pet. Engineers
Cased Hole Logging, Schlumberger Well Services
Open Hole Well Logging, Welex
Advanced Open Hole Well Logging, Welex
Class V Injection Wells, Engineering Enterprises
Mechanical Integrity Testing, Engineering Enterprises
Simulation of Hazardous Waste Injection, Scientific Software
UIC Enforcement Training, USEPA - Headquarters
Environmental Risk Analysis, USEPA - Region V
Hazardous Waste Safety Training, HST
Hazardous Waste Safety Training For Managers, HST
Professional Liability, CH2M HILL
Speaking with Others, CH2M HILL
Various Computer Short Courses, Various
First Aid and CPR, Red Cross

Note: Mr. Arthur attends several conferences each year that are not listed. Further, the above list does not necessarily include courses completed for CEU required for maintenance of various Professional Engineering Licenses.

*Expert Evaluation of Raul Gonzales, et al. v.
Fidelity Exploration and Production Company*

Appendix D: List of Recent Testimony

J. Daniel Arthur, P.E., SPEC

Listing of Cases (Generally Limited to those where an Expert Report was Prepared or Testimony was given)

2013-Present (March 2018)

1. Almont Energy, LLC v. Citizen Energy, LLC (2018-present)

- a. In this case, Mr. Arthur serves the Plaintiff's Council as an expert and has prepared an expert report. The case is ongoing.

2. PGE v. Pennsylvania Department of Environmental Protection (2017-present).

- a. In this case, Mr. Arthur represents PGE in a challenge pertaining to permitting in the State of Pennsylvania. Mr. Arthur was asked to prepare an expert report and it currently appears that both parties have reached a potential settlement.

3. Sheila Darlene Butler v. Ohio Transmission Corporation; Blue Racer Midstream, LLC.; Hunt Guillot & Associates, LLC.; and Buffalo Gap Instrumentation & Electrical CO, Inc. (2017-ongoing). Case 16CV00962 (Franklin County Ohio, Judge Colleen O'Donnell).

- a. In this case, Mr. Arthur serves as an expert for Defendant, Blue Racer Midstream, LLC. Mr. Arthur has supported the case, but not yet prepared an expert report. The case is ongoing.

4. Maximo Soto and Piedad Soto v. DCP Inc., et al; Case No. 16-CV-1410-M; in the District Court of the Western District of Oklahoma (2018).

- a. In this case, Mr. Arthur represents the Plaintiff and has prepared an expert report. The case is ongoing.

5. Colorado Oil & Gas Commission

- a. COGCC Complaint No. 200402859
- b. NOAV No. 400995107
- c. In this case, Mr. Arthur supported the Colorado Oil & Gas Commission in an enforcement case where groundwater wells were impacted by oil & gas production activities. Mr. Arthur prepared an expert report and assisted in settlement strategies.

6. Singer Oil Company, LLC v Newfield Exploration Mid-Continent, Inc. and Halliburton Energy Services Inc. (Case No. CJ-2016-??)(2017).

- a. In this case, Mr. Arthur represented the Plaintiff (Singer Oil Company). Mr. Arthur was deposed by the Defendant's Council and testified in Federal Court in Oklahoma City, OK. The Defendant also made a Daubert Challenge against Mr. Arthur and Mr. Arthur survived the challenge.

7. David Ridley Oil, LLC v. Silver Creek Oil & Gas, LLC. (2016-2017).

- a. In this case, Mr. Arthur represented the Plaintiff (David Ridley Oil, LLC) and he prepared an expert report, was deposed, and assisted in settlement negotiation strategies.

8. Mark and Renea Ely v. Enterprise Crude Pipeline, LLC. (2016).

- a. In this case, Mr. Arthur served as an expert for the Defendant (Enterprise Crude Pipeline, LLC.) and prepared an expert report used in settlement negotiations.

9. Hull, et al v. JP Energy (2016 and ongoing).

- a. In this case, Mr. Arthur represented the plaintiff (Hull SWD) and prepared an expert report used for proposed settlement purposes and possible ongoing litigation purposes. The case has not settled, but has been idle.

10. Testimony on Florida Hydraulic Fracturing Rule, for Florida Department of Environmental Protection (FDEP), State Senate Committee, 2015.

- a. Mr. Arthur represented the State of Florida and spoke to the State Legislature at the request of the State AG.

11. Ohio Department of Natural Resources v. Southeast Ohio Association to Save our Water (2014).

- a. Mr. Arthur was brought in by the Ohio AG office to assist in a case brought against the State of Ohio. Mr. Arthur prepared a Draft Expert Report, but the case was dropped.

12. Range Resources v. Pennsylvania Department of Environmental Protection (2015 to ongoing).

- a. In this (potential) case, Mr. Arthur represents the Defendant on potential enforcement litigation. The initial complaint against Range Resources was dropped, but Mr. Arthur continues working on the case in the event it moves forward. Mr. Arthur has prepared an expert report and participated in negotiations with the Department.

13. FDEP v. Dan A. Hughes, various meetings (2013-Present)

- a. NOTE: This involved seven (7) separate enforcement cases and Mr. Arthur prepared various documents, reports, and assisted the State negotiate details that led to settlements. Mr. Arthur represented the State.

14. Manning, et al v. WPX Appalachia, LLC (Deposition Only), 2015

- a. Mr. Arthur represented the Defendant (WPX) and prepared an expert report, was deposed, and assisted with settlement strategies.

15. RROC, Inc. v. Trisun Energy Services, LLC (Case No. 01-15-002-4997)(2015).

- a. In this case, Mr. Arthur served as an expert for Trisun Energy Services (defendant) and prepared an expert report used for settlement purposes.

16. American Water Management Systems v. Ohio Department of Natural Resources, 2015

- a. Mr. Arthur prepared an expert report and testified at a Hearing with the Ohio Oil & Gas Commission. He represented AWMS.

17. Lauren Engineers & Constructors, Inc. v. BAE Systems (2016-2017).

- a. In this Arbitration case, Mr. Arthur represented the plaintiff, Lauren Engineers & Constructors, Inc. Mr. Arthur prepared an expert report that was used in negotiations. However, a new law firm was brought into the case and the current status of this case is uncertain, but believed to have settled.

18. Lauren Engineers & Constructors, Inc. v. Aquatech International Corporation (2015).

- a. In this Arbitration Case, Mr. Arthur represented the Defendant (Lauren Engineers & Constructors, LLC). He prepared an expert report and assisted with settlement strategies. The case settled.

19. Equipment Transport Qualeo SWD Well Hearing (Texas Railroad Commission), 2014

- a. Mr. Arthur testified on behalf of Equipment Transport at a Hearing with the Texas Railroad Commission.

20. HDR Constructors, Inc. v. Waste Connections, Inc., Successor to R360 Environmental Solutions, Inc., 2015

- a. Mr. Arthur represented HDR. He prepared an expert report and was deposed.

21. Jacqueline Place v. Chesapeake Appalachia, 2013

- a. Mr. Arthur represented the Defendant (Chesapeake Appalachia) in this Arbitration. He prepared an expert report and testified at the arbitration.

22. New Mexico Oil & Gas Association Pit Rule, 2012

- a. Mr. Arthur served as the Expert representing the New Mexico Oil & Gas Association. He testified at the NMOCD Hearing.

23. Brandon Eaves, complaint #2572; Taylor, D.R. Heirs, Well #9; Joaquin (Travis Peak) Field, Shelby County, Texas v. Classic Hydrocarbons, 2011.

- a. Mr. Arthur represented the Defendant (Classic Hydrocarbons), prepared a report submitted to the Texas Railroad Commission and assisted in settlement discussions.

Additional Cases

Mr. Arthur has and continues to serve as a testifying or consulting expert on multiple cases for both Defendants and Plaintiffs. However, these other cases have either not yet developed to the point of requiring an expert report/deposition/testimony or did not develop to the point of requiring an expert report, deposition, or testimony.